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Index to Advertisers and Classified Index Following Reading Matter.

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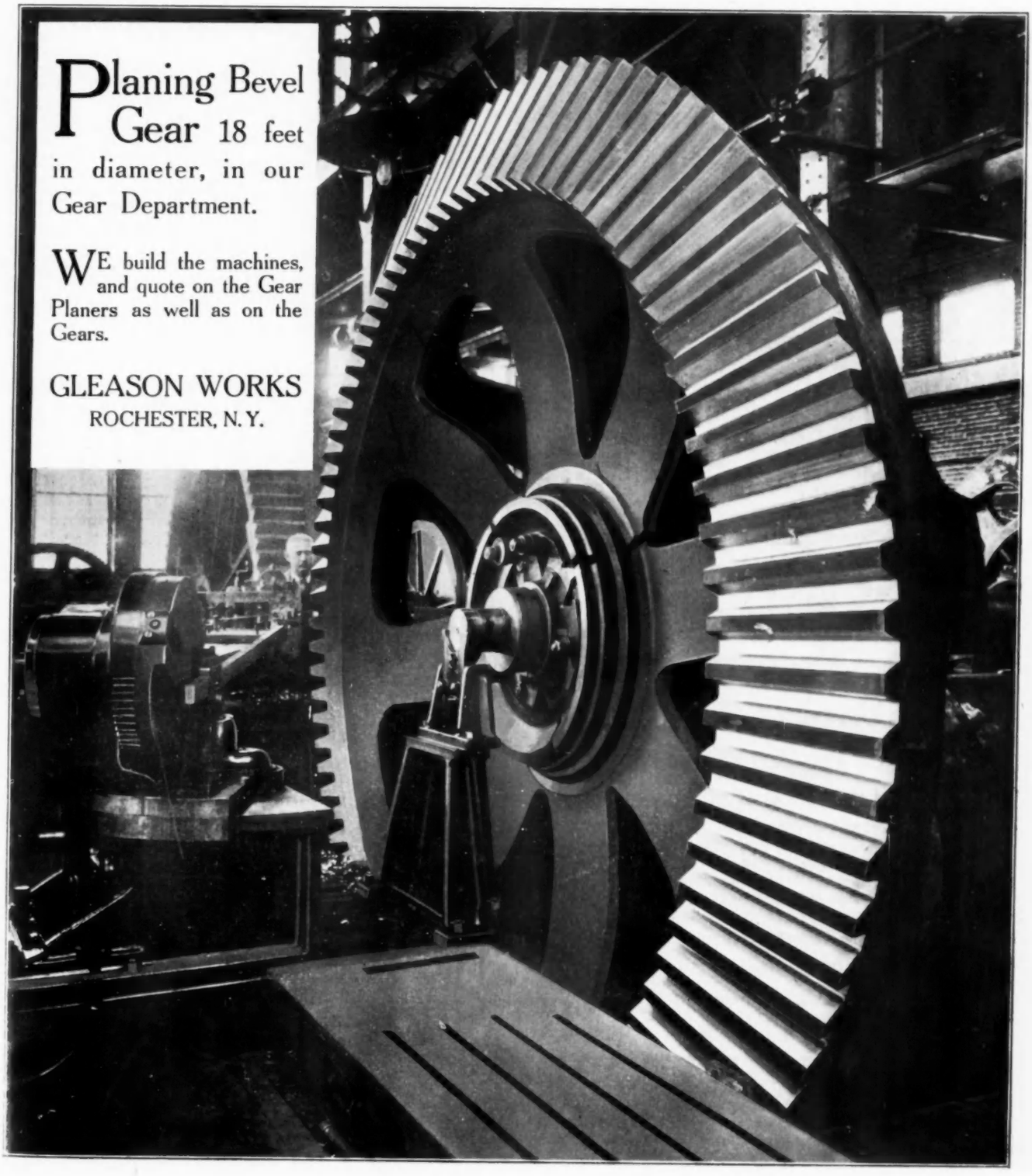

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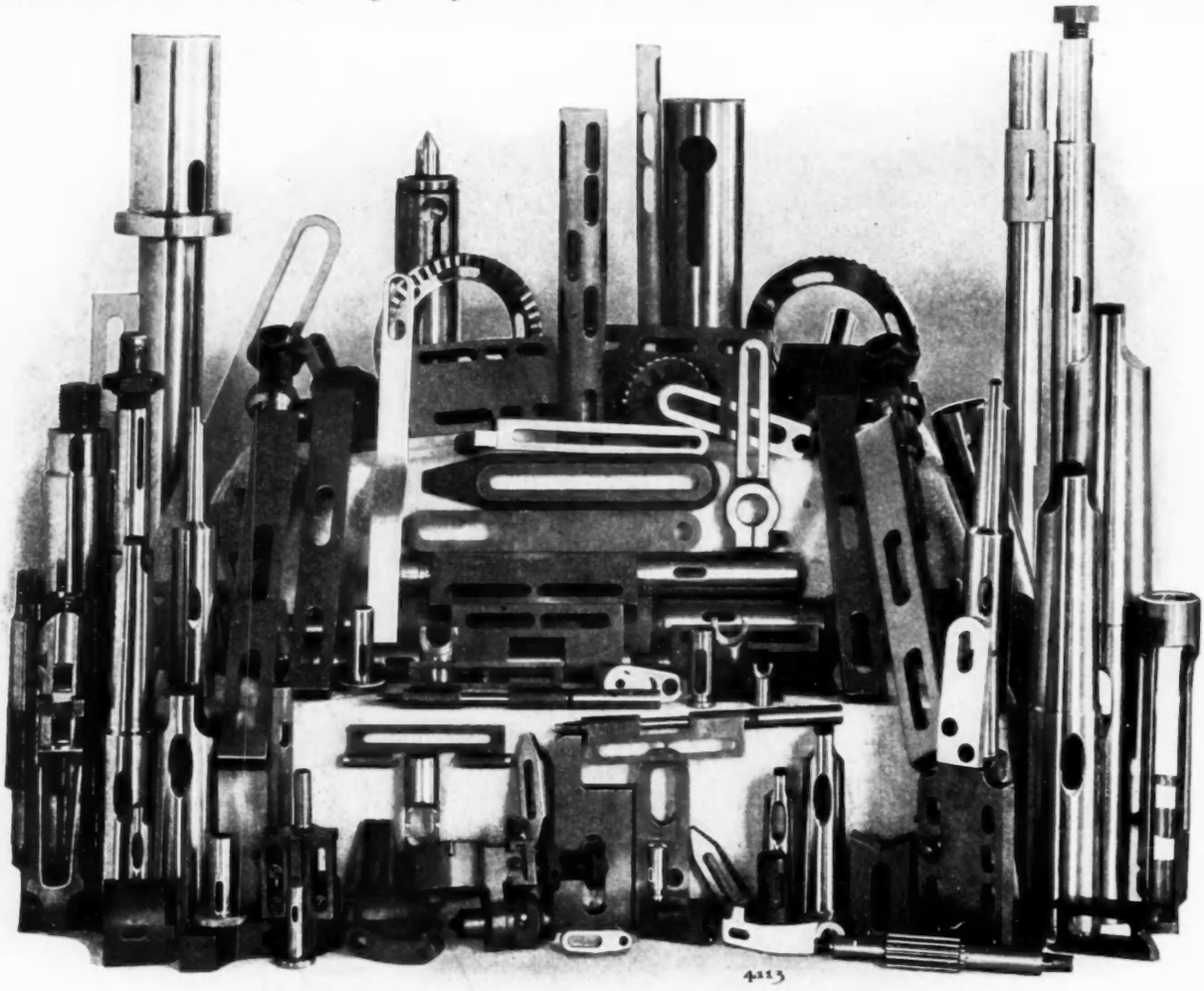

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Complete description with illustrations, pages 1 to 5, American Machinist, July 2, 1908.

Write for new illustrated catalog "The Spline Milling Machine."

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Accurate Index Wheels and Milling Operations

The Channels in the Cylinders of the Unitype Company's Typesetting Machine Are Correctly Located and Cut with Special Machinery

EDITORIAL CORRESPONDENCE

An accurate index wheel over 3 feet in diameter and having 90 indexing plugs correctly located about its periphery constitutes of itself an important piece of machine work. At the Unitype Company's shop, Brooklyn, N. Y., 10 such wheels are in service on as many special machines employed for cutting longitudinal channels in the surfaces of the cast-iron cylinders forming the bodies of the type-setting machines built by that concern. This row of 10 channels forms a unique battery of machines, several members of which are represented in the halftone illustration, Fig. 1.

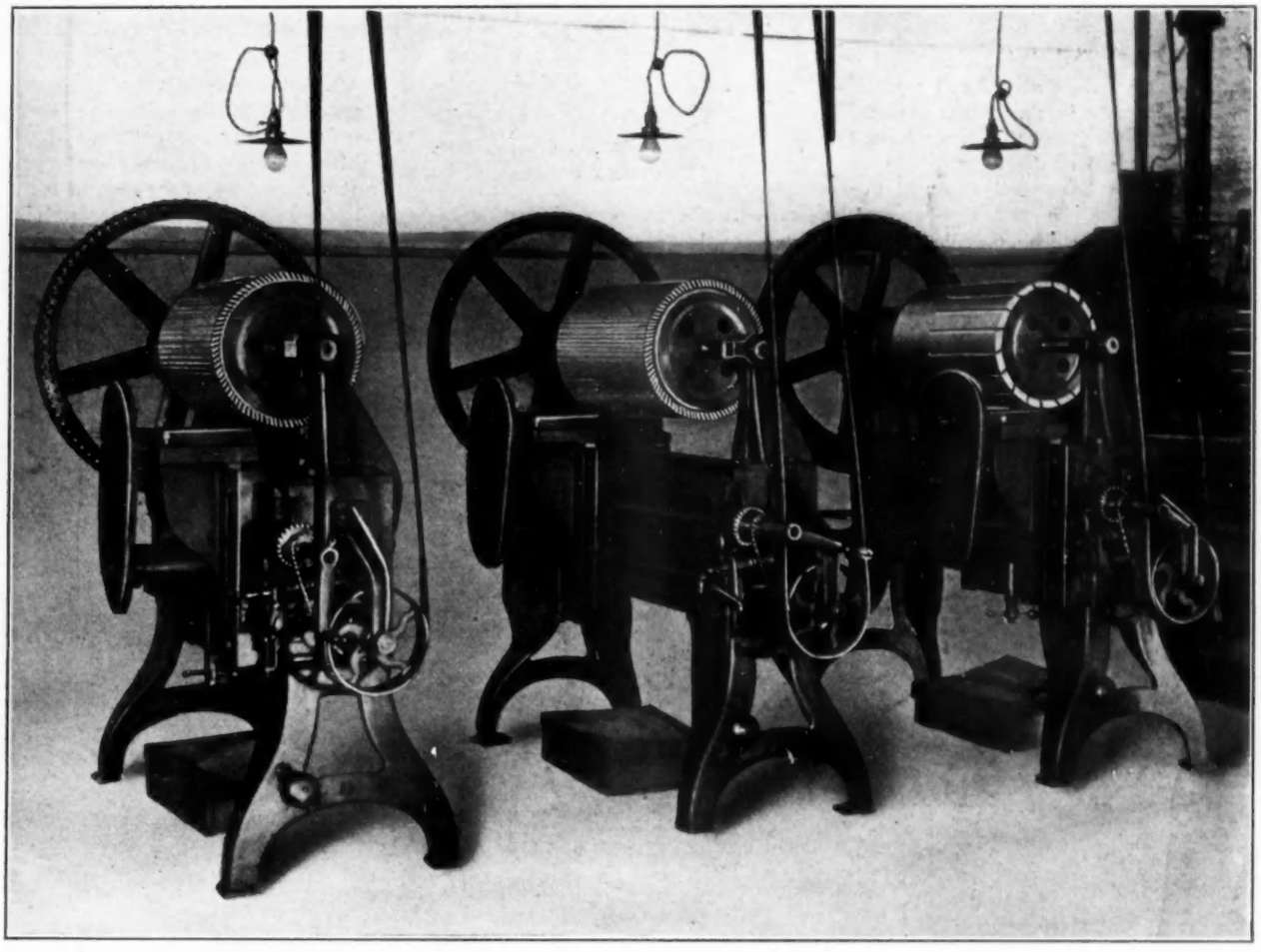


FIG. 1. GROUP OF SPECIAL MACHINES FOR MILLING CHANNELS IN TYPE SETTER CYLINDERS

The Typesetter Cylinders

The Unitype Company's machine has two vertical cylinders placed one above the other, as represented in Fig. 2. In the periphery of each cylinder are 90 longitudinal channels equally spaced about the circumference and cut at an angle, as indicated by the single channel shown in the sketch. The upper cylinder *A* is called the distributor; the lower cylinder B is the magazine. The "dead" type is automatically loaded into the distributor channels in *A* and the latter is rotated step by step by a cam and roller movement bringing each channel in succession over each of the channels in cylinder *B*. The latter channels have a series of steel wards or ribs set into the forward face, as shown at *a*, *a*, in Fig. 3. The ward combination in each channel differs from all the other combinations and corresponds to the combination of notches in the edge of one type character only. Therefore, as the type is carried around by the distributor cylinder the character at the bottom of each line of "dead" type in the distributor can only drop into the proper channel in the magazine. Thus each magazine channel forms a receptacle for a given type character, and from this cylinder the type is reset by ingenious mechanism controlled from a keyboard at the front of the machine.

In order that the type may drop properly into the magazine as the upper cylinder is rotated step by step, the edges of the channels in the two cylinders must match exactly; the cutting of these channels is, therefore, a very important operation.

The Channel Locations

As will be seen upon inspection of the sketches, Figs. 2, 3 and 4, the outer edge of the channel is cut 4 3/16 inches from the center of the cylinder; that is, it is tangent to a circle of 8⅜ inches diameter. This location off center naturally adds to the difficulty of producing a series of straight, narrow channels of the depth

required, which is about ⅞ inch. The width of the slot varies in different cylinders according to the size of type to be handled, but whatever the width, the positive side of the channel is 4 3/16 inches from the center line.

The channeling operation on three different pairs of cylinders is represented in Fig. 1; the sketch, Fig. 4, will make the cutter application a little clearer. In this illustration a few slots or channels are represented as already cut and the cutter is seen in working position. A cutter of the side-milling type is used, the diameter being about 6½ inches. This cutter, although quite thin as compared with its diameter, produces a straight slot, true to size and smoothly finished.

Cutting the Slots

The two cylinders are placed side by side on the arbor in the channeling machine, as in Fig. 5, and the cutter started at the bottom end of the lower or magazine cylinder. The work is indexed five spaces at a time the first time around, every fifth cut thus being made on this round. The next time around an intermediate cut is made between each pair of channels, and so on for the following cuts. In this way errors likely to occur through local heating and distortion of the metal are avoided.

Fig. 5 represents the work in the position it occupies on the slot-cutting machine with the cutter just starting in at the end of the cylinder *B*. In cutting the channels, they are not milled through from end to end at the outset, but instead the cuts are first run up to about ¾ inch of the point where the cylinders abut against one another. It is absolutely essential that the channels in the two members shall match exactly and so the cutting of the portions of the channels across the joint between the cylinders is left until after all the 90 channels have been cut about to point *a*, Fig. 5. Then with a newly sharpened cutter the channels are cut across the joint as at *b*, the work being indexed first for every fifth space as was done in cutting to *a*, and the intermediate channels then being extended across the joint. As before, the work is indexed five steps for each cut, and every precaution is taken to prevent inaccuracy in the matching of the slots of the two cylinders.

After the slots have all been milled across the joint, the remaining short portion indicated at *c* is cut, each slot being finished in turn, as there is no necessity in the case of the upper ends of the channels for taking the extra precautions observed in milling across the matching surfaces of the two cylinders.

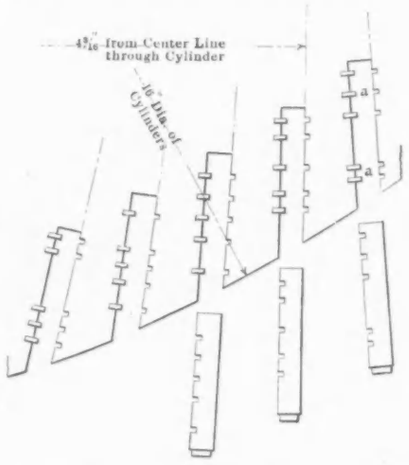
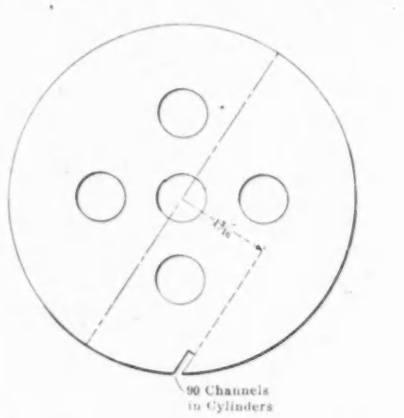


FIG. 3. PLAN OF PORTION OF MAGAZINE CYLINDER



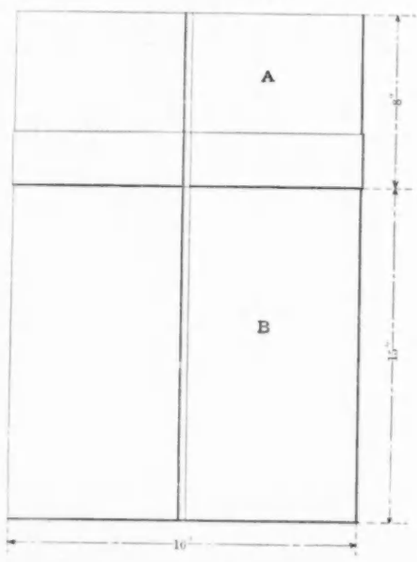


FIG. 2. CYLINDER PROPORTIONS

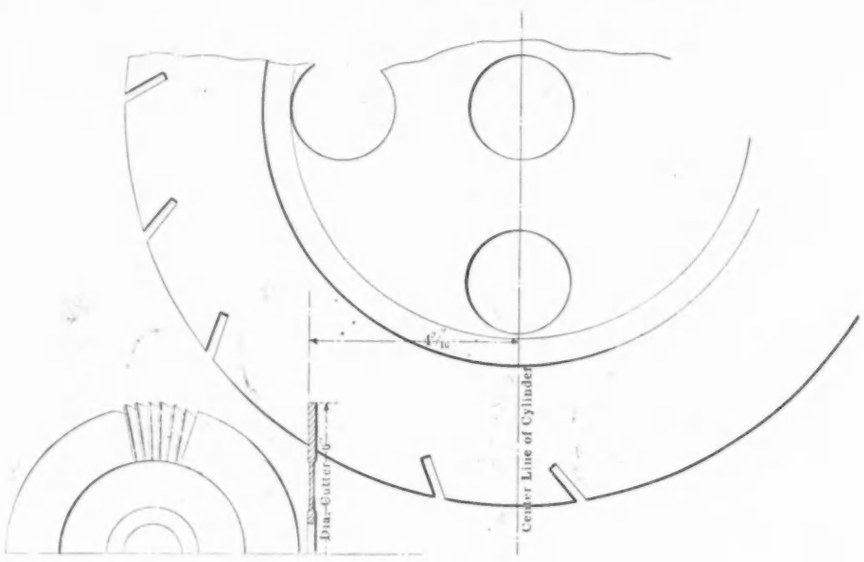


FIG. 4. THE WORK AND THE CUTTER

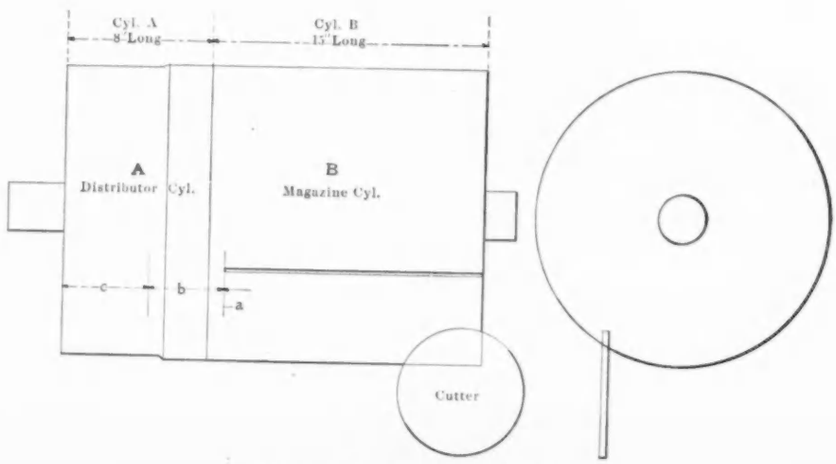


FIG. 5. CUTTING THE CHANNELS

The Index Wheel

Naturally the accuracy of the results obtained in the channel-cutting machines is dependent mainly upon the correctness of the index wheels. As the slots in the cylinders must match exactly in every one of the 90 positions which the upper cylinder assumes upon the lower when in operation, it will be seen that the index wheel must be very accurately constructed. Details of the wheel are given in Fig. 6.

As there represented, the rim of the wheel has 90 holes bored through to receive as many indexing plugs the shanks of which enter very freely in the holes. The plug bodies *A* for any given wheel are ground to exactly the same diameter, and this diameter and the diameter of the wheel surface at *B* are such that with all the 90 plugs in place, they just contact with one another and also with the surface *A*. The series of plugs thus exactly spaced form a ring of about 36 inches diameter. The screws *C* in the rim of the wheel hold the plug bodies against the seat at *B* and nuts like *D* secure them to the wheel rim. As shown by the dimensions given, the plug shanks have 1/32 inch freedom in the holes through the wheel rim, so that they in no way affect the location of the plugs.

FIG. 7. MILLING NARROW WARD SLOTS

Operation of the Wheel

The front ends of the plugs are slightly tapered, and fit a taper hole in a locking pin arranged to slide in a bearing at the right-hand side of the machine. The locking bolt is drawn back by hand after each cut, to release the index wheel and after the latter has been turned ahead the required distance the locking member is pressed back over the corresponding plug and the machine is then ready for the next channeling cut to be taken. After

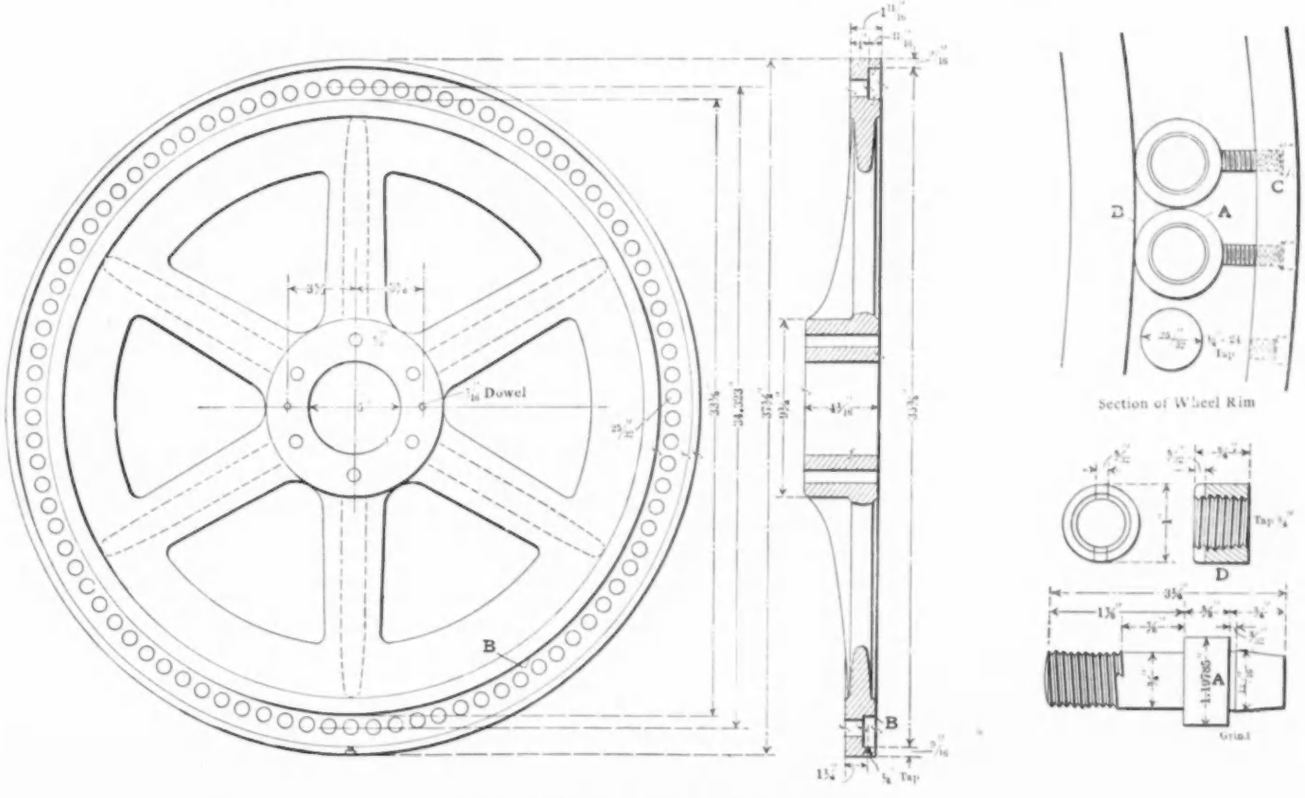


FIG. 6. INDEX WHEEL CONSTRUCTION

the indexing operation the cutter-slide feed is thrown into action and upon completing the forward stroke, it automatically reverses and returns the cutter slide at a rapid rate of speed.

Milling the Ward Slots

Reference has been made to the wards or steel ribs *a a* at the sides of the channels in the magazine cylinder, and in Fig. 3 some of the combinations in different slots are represented. The type sketched at the front of each slot is merely to show the corresponding notches in the edges of the type which permit any given character to drop from the distributor cylinder into its own channel in the magazine and into no other. The shallow notches in the cylinder channels directly opposite the wards, are merely clearance slots which the cutter forms in milling the ward grooves.

The wards themselves are set snugly in their slots and riveted slightly at the top to secure them in place. The method of cutting the slots to receive them is shown in Figs. 7 and 8.

The cylinder is mounted on a vertical spindle carrying two adjustable horizontal arms connected at the outer end by a vertical bar on which is a sliding cutter head, the spindle of which is driven by a small, round belt. The cutter head has a flat steel guide which fits nicely in the channels milled in the cylinder and which forms a bearing for the body of the delicate T-slot cutter used for milling the ward slots. This cutter is just visible at the inner side of the guide in Fig. 8, and is more plainly seen in the sketch, Fig. 9. The diameter of the mill and its position in the guide are such that it will cut the ward slots to the required depth. The location of the cutter endwise to form the different slots in their right positions in the cylinder channel is determined by gage blocks which are placed between the supporting bearing on the cylinder spindle and a fixed block on the adjustable frame carrying the cutter head. The operator has a table giving the spacing for every series of notches in the cylinder and gages to give the corresponding settings, so that he readily adjusts the cutter-carrying frame in and out as required for the various combinations.

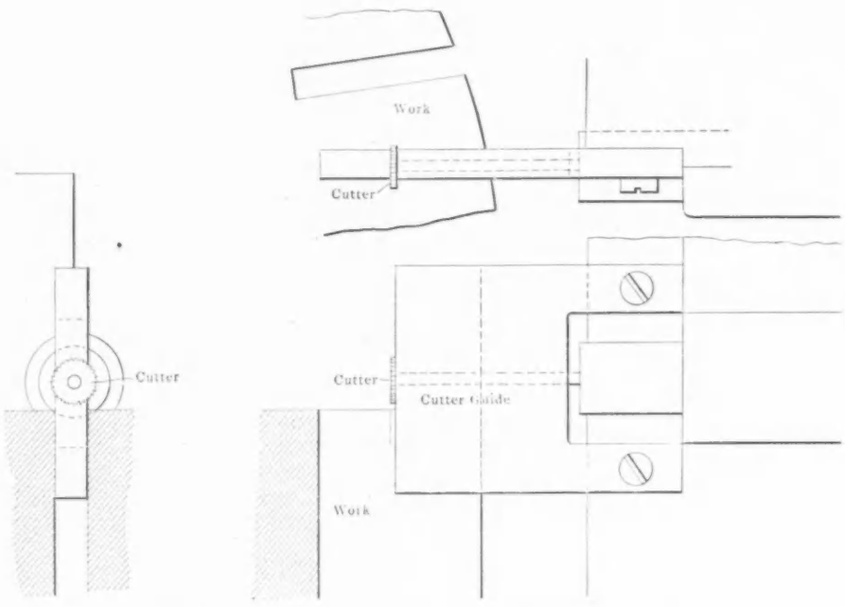


FIG. 9. ARRANGEMENT OF CUTTER AND GUIDE FOR MILLING WARD SLOTS

FIG. 8. MILLING NARROW WARD SLOTS

The cutter is about 3/16 inch diameter by 0.040 inch thick. The slot is cut approximately 1/16 inch deep. The cutter is driven at high speed and is easily fed down by hand during the delicate slot-milling operation.

F. A. S.

In a report recently submitted to the San Francisco Chamber of Commerce it is interesting to note that since the discovery of gold in Eldorado county by James Marshall in the year 1848 the State has produced gold value of $1,452,785,767. The record single year's production was in 1852 when the output reached the figure of $81,294,700. The years from 1850 to 1862 were the largest yielding ones during which period an average output of $55,000,000 was maintained annually.

The best all-round rock-drill steel (W. E. Kimber, *Journ.* Transvaal Inst. Mech. Eng., May, 1908) contains, according to the manufacturer's rating, 0.50 to 0.60 per cent. carbon, for this combines maximum toughness with a hard cutting edge. Milder and cheaper steel should be used for the shanks since it is cheaper, welds up to the cruciform easier, and is less liable to crystallize and break.

A Complete Line of German Air Compressors

Throughout This Line a Light, Simple Valve Is Used for Services from Blast Pressure to 2100 Pounds per Square Inch

BY NEWHAUS W. CZENAISON

During the last few years a compressor system, remarkable for its extreme simplicity, has made its way all over Germany; it is the Borsig type, made by A. Borsig, Tegel, Germany, of which the following is a description:

The most essential feature of this type of compressor is the Borsig valve, as shown in Fig. 1. This valve consists of a cast-iron seat, a thin valve plate made of steel stampings, which, by means of two arms fixed by plugs, is guided without friction, and the valve guard controlled by a spring. Fig. 2 shows all these parts in detail. Although this valve may, on account of the trifling weight of the real closing part, the valve plate, be run at the highest possible number of revolutions, it is perfectly noiseless in action. The only purpose that the spring has to serve is to effect the closing of the valve plate at the proper time. Suction- and pressure-valve parts are the same, so that the same plate may be employed for both valves and, therefore, only one kind of spares need be kept on hand.

The method of inserting the valves into the casings is shown in Fig. 3. The valve is inserted in the grooves of the casing which correspond exactly to those of the seat and is pressed tightly into it by means of stems cast onto the closing cover. The tightening of the valve and the cover is effected by rings made of a suitable graphitic material. The superiority of this simple arrangement has, up to a pressure of 15 atmospheres, always proved satisfactory.

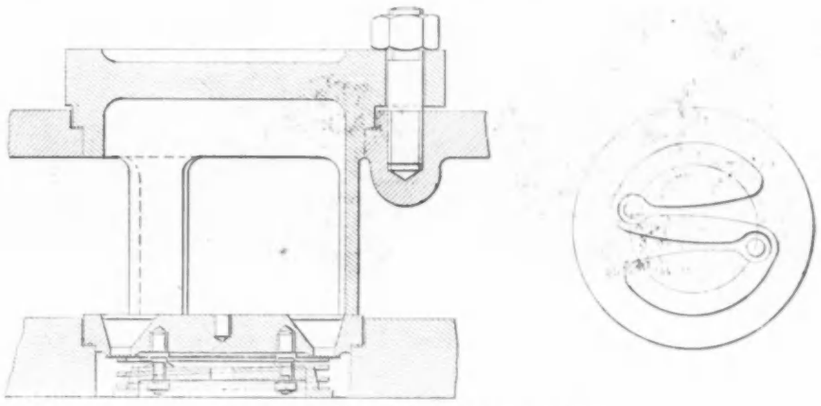


FIG. 3. METHOD OF HOLDING THE VALVES

The Borsig compressors are built in various sizes; steam or belt driven, or direct-connected with electric motors or internal-combustion motors, in order to suit all purposes that may arise.

Single-stage Types

Fig. 4 shows a standard double-acting, one-stage, single-cylinder, belt-driven air compressor destined for a medium air pressure of 7 atmospheres. The driving gear of this compressor is the same as that of an ordinary steam engine. The

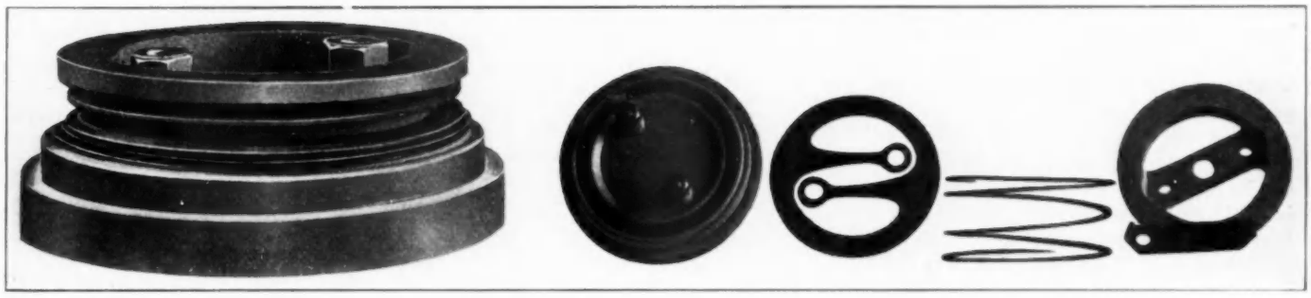


FIG. 1. A BORSIG AIR-COMPRESSOR VALVE

FIG. 2. A BORSIG AIR-COMPRESSOR VALVE DISASSEMBLED

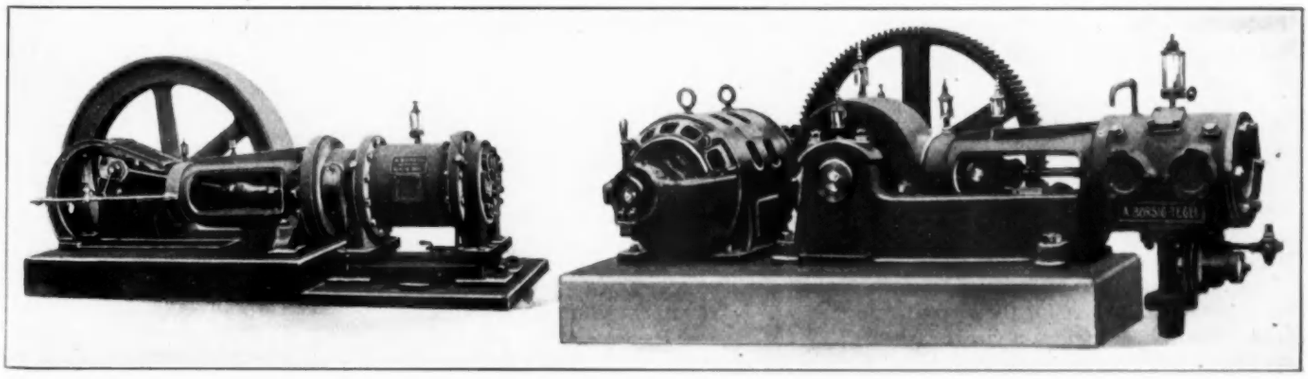


FIG. 4. A STANDARD SINGLE-STAGE BELT-DRIVEN BORSIG COMPRESSOR

FIG. 5. A STANDARD SINGLE-STAGE MOTOR-DRIVEN COMPRESSOR

air cylinder is centrically joined to the strong bayonet frame; the cylinder itself consists of three parts; the two valve casings fitted as cylinder covers, the center part, and the jacket. When dealing with engines with a stroke of up to 500 millimeters (20 inches) the valve casings are fixed to the base plates by means of rectangular flanges, which at the same time serve as connecting pipes between the suction and pressure chambers. The cylinder of engines with a stroke of more than 500 millimeters (20 inches) are fitted with bracket feet. Thus it is possible to employ the same valve casings for the various cylinder diameters and thus only a small number of patterns are required. The valves, when inserted into the cylinder covers, offer the advantage of reducing the clearance, which in normal sizes generally amounts to from 2 to 2½ per cent. Engines having a stroke of under 250 millimeters (10 inches) are fitted with a base plate in the shape of a forked frame and a bent crank-shaft supported by two bearings. The belt wheel is arranged to overhang.

The engine is, as shown in Fig. 5, of very simple construction, and the erection can be readily accomplished. The cylinder is made as one piece and the valves are fixed into cast-on lateral pockets. This construction requires, however, a somewhat larger clearance, the unfavorable effect of which must be compensated for by an overflow of the cylinder. This overflow is effected by slits arranged in the cylinder, which are governed by the piston itself, thus adjusting the two sides of the engine. Thus a very good volumetric effect is obtained, so that engines of this kind are able to draw, in comparison to their size, a considerable volume of air. When dealing with only small capacities, as for instance, with a quantity of up to 0.9 cubic meter (25 cubic feet) of free air per minute, one-stage, single-acting, high-speed compressors are employed. The hollow-plunger piston serves as a crosshead and support for the connecting-rod joint. These engines, a view of which is given in Fig. 6, are distinguished by their extreme simplicity of construction and the small space they occupy. They are, on account of their high speed, up to about 400 revolutions per minute, very suitable for direct connection to motors.

The construction of the standard Borsig steam-driven compressors, as shown in Fig. 7, differs in no way as far as the air side is concerned, from the belted compressors of the same size. The air and steam cylinders of these engines have a common base plate that supports the flywheel bearings. Two overhanging flywheels are fitted to the shaft which, by means of two rods, are connected with the traverse between the two cylinders; steam- and air-piston rods are attached to the latter. The valve gear, which is directly governed by an eccentric rod, is a precision Rider gear, and is controlled by a spring regulator. This type is very compactly designed, so that, in spite of the limited space, large capacities may be arranged, and yet all parts may be readily inspected.

The one-stage compressors are fitted only with jacket cooling; the compression is, therefore, nearly, according to the law $p v^{1.32}$. Engines of this kind are generally employed for pressures up to 6 atmospheres.

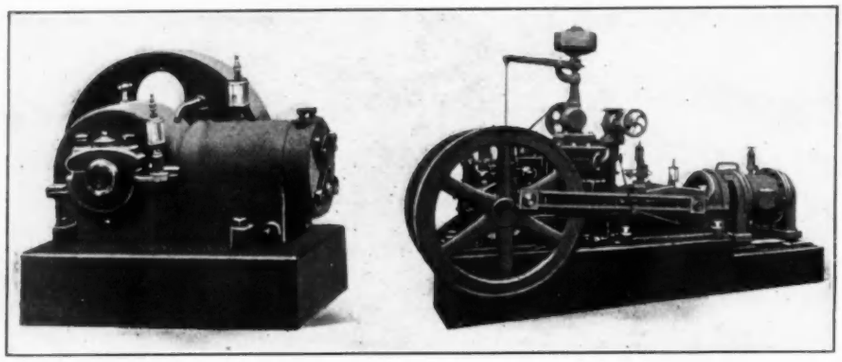


FIG. 6. A COMPACT TYPE OF AIR COMPRESSOR

FIG. 7. ANOTHER STANDARD TYPE

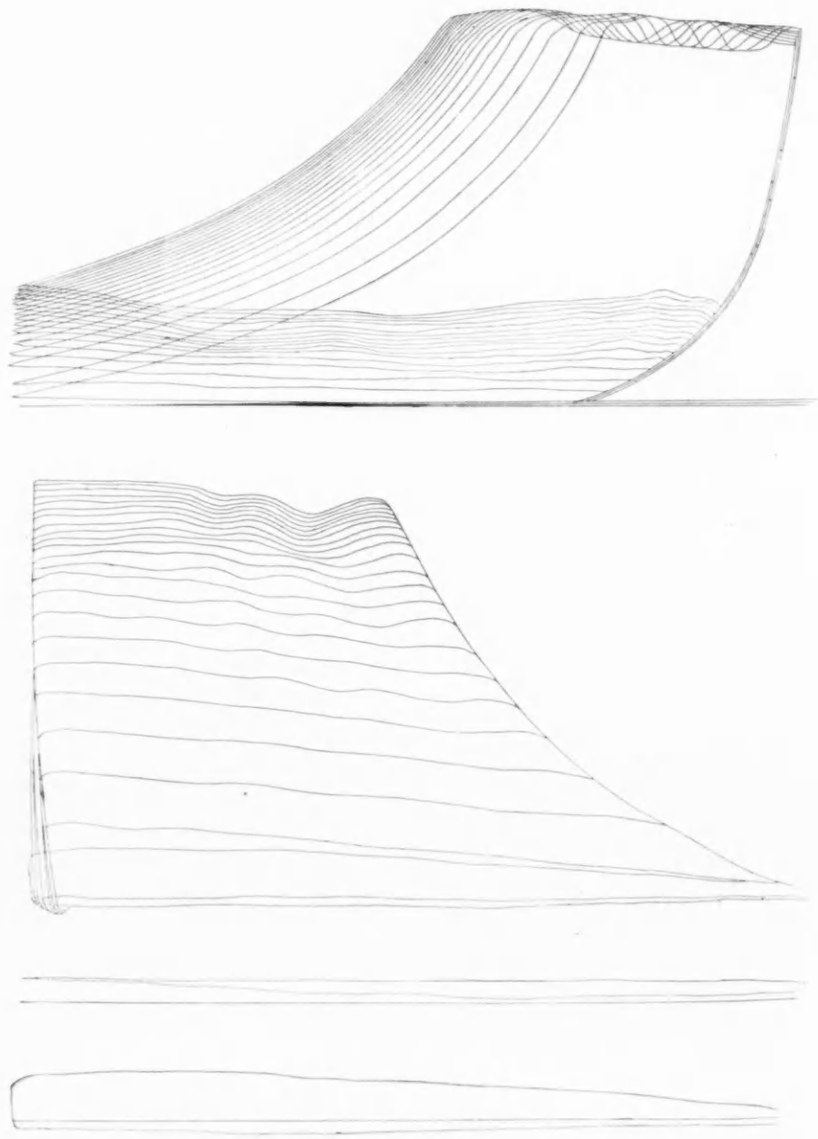


FIG. 8. DIAGRAMS FROM A TWO-STAGE COMPRESSOR

Two-stage Types

In order to handle pressures of 6 atmospheres or more, it is well to have the compression done in two stages and let the air which has been warmed in the first stage pass through an intercooler where it is cooled down to the initial temperature and in this way the volume is reduced. It is well known that through this process, especially when dealing with engines of larger sizes, considerable work is saved as the air which is compressed in the second stage is of less volume than if it had not been cooled. Fig. 8 shows

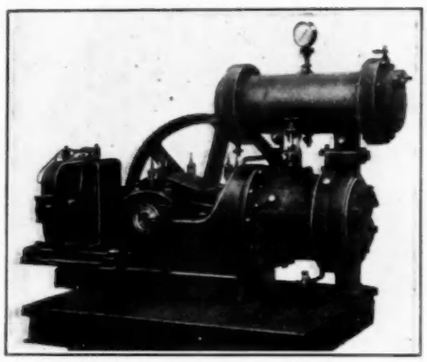


FIG. 10. A COMPACT MOTOR-DRIVEN TWO-STAGE AIR COMPRESSOR

this procedure in detail. In the first stage the compression is to an intermediate pressure, generally very much like the terminal pressure, following the law $p v^{1.32}$. Then the cooling of the air on isothermal lines begins and after that again compression as per $p v^{1.32}$. The hatched space, which according to the above law, lies between the two curves, represents the saving of work from the intercooler. A further advantage of the two-stage compressors is the trifling temperature of the air at the outlet and the smaller strain and better utilization of the driving gear. Compound compressors of larger sizes are constructed as double-acting two-piston engines and also as tandem engines no matter whether they are steam- or belt-driven. The intercooler is in this case generally placed under the floor.

Fig. 9 is a view of a standard steam-driven, compound compressor, the air cylinders of which are placed at the back of the steam cylinder. The steam engine

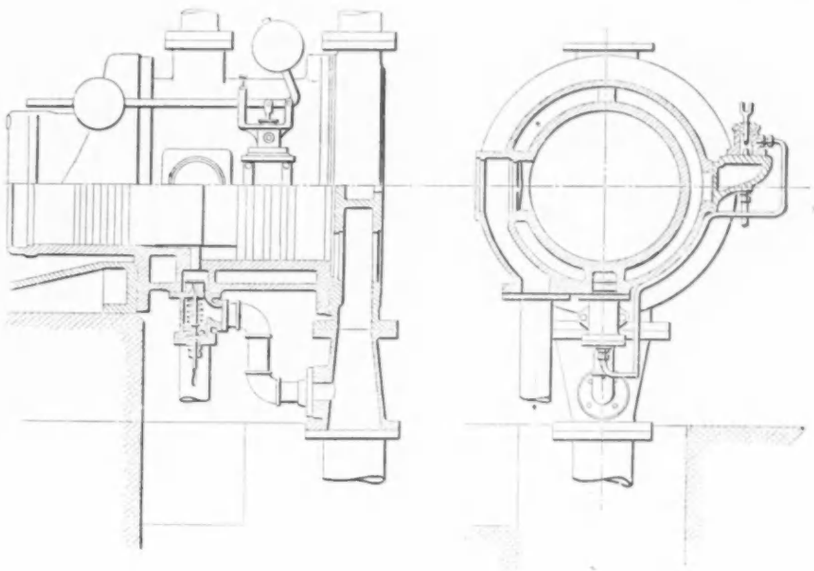


FIG. 11. DETAILS OF AUTOMATIC PRESSURE REGULATOR

is a standard engine fitted with a slide-valve gear. In order to regulate the air quantity in a more efficient way, a regulator worked by hand has been supplied, or, the regulator is arranged in such a way that it is directly influenced by the air pressure, so that the speed of the engine may be automatically regulated according to requirements.

However, for a quantity of free air up to 20 cubic meters (600 cubic feet) per minute, the two-stage compressor is more advantageously fitted with one cylinder, in which a hollow differential piston moves up and down, serving at the same time as crosshead and support for the connecting-rod joint.

The intercooler is conveniently arranged on the top of the cylinder and is easily accessible, so that the air may pass from one stage to the other in the shortest way. The engines of this type are compactly built and, therefore, require only a small space.

In order to facilitate and to cheapen the erection of engines of smaller sizes, the engines of short stroke are built with a belt crank-shaft and fitted with a fly-wheel. Engines of this type may also very conveniently be coupled with an electric motor, and in this case gearing is generally chosen. The motor is placed

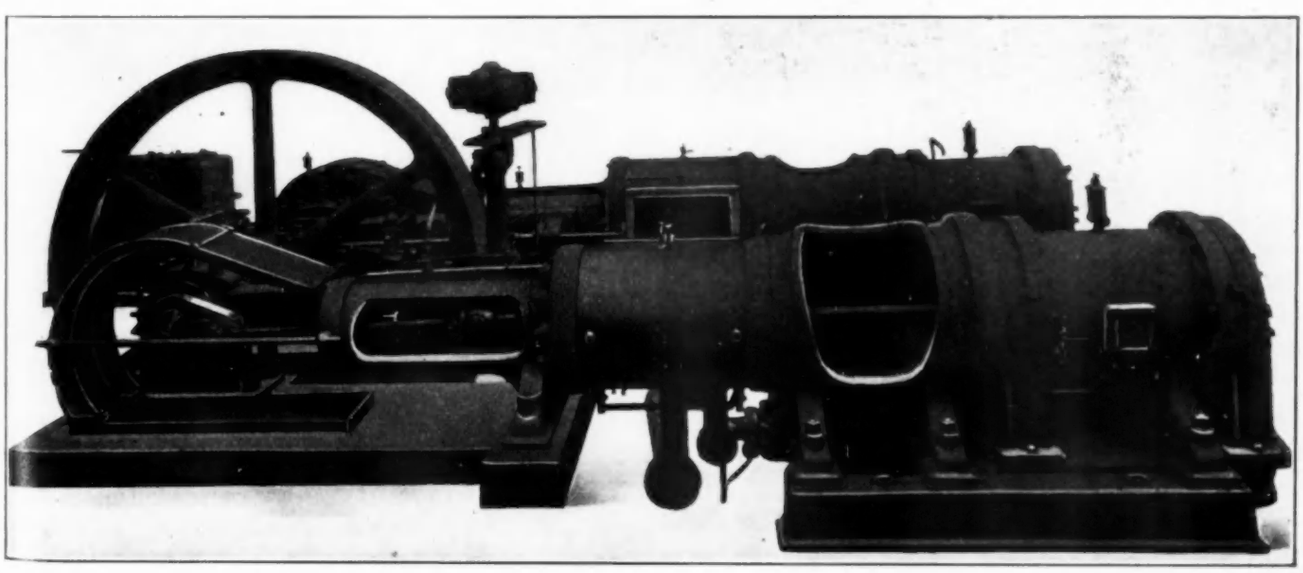


FIG. 9. STANDARD BORSIG TWO-STAGE STEAM-DRIVEN AIR COMPRESSOR

on a special base plate, firmly linked with the compressor base plate, as shown in Fig. 10. The small driving wheel of the motor is made of rawhide, so that a noiseless working is obtained, while the large flywheel is of cast iron.

These single-cylinder compound engines are, on account of the advantages which they offer, especially suitable for

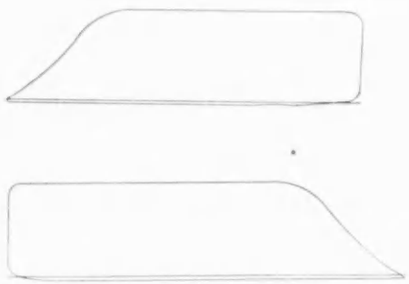


FIG. 14. AIR DIAGRAMS FROM A BLOWING ENGINE FITTED WITH BORSIG VALVES

use in works where compressed air is required for pneumatic tools; they combine an economical service with cheap first cost, occupy a small space and require but little supervision. These compressors are also built as two-stage high-pressure engines up to a terminal pressure of about 35 atmospheres and are frequently employed as starting compressors for gas engines.

The compressors are fitted with an automatic regulating device, which, by means of a pressure regulator and waste valve cuts off the air supply in the event of the air pressure exceeding a certain prearranged amount, and opens automatically as soon as the pressure has dropped to a certain amount. Fig. 11 shows a view of this device. The compressed air is conveyed underneath the pistons to the circulation valve leading into the interior of cylinder, thus establishing a communication with the suction pipe through which the air is returned as soon as the maximum pressure has been reached and the piston of the weight-controlled governor goes up. The pressure valves of the high-pressure side of the compressor serve at the same time as return valves in the direction of the air tank. The compressed air at the back of the circulation-valve piston is allowed to escape into the open air and the valve is closed by a spring when, through the decrease of pressure in the air tank, the regulator is closed. The compressor then restarts immediately. This arrangement saves a considerable amount of power as the work of the compressor, when running empty, represents only a fractional part of the total work. Besides the supervision which the compressor might require is reduced to a minimum.

High-pressure Types

For some years past the construction of large high-pressure compressors for an especially high compression such as is required for torpedo stations, has been taken up. Fig. 12 is a view of a three-stage, steam-driven air compressor capable of compressing 2.5 cubic meters (75 cubic feet) of air at a pressure of 150 atmospheres which has been duplicated several times, for the Imperial Ship Building Yard at Wilhelmshafen. A steam compressor of a considerably larger size was delivered a short time ago to the torpedo station at Friedrichsort. This compressor is driven by a compound steam engine, which on one side is fitted with the high- and low-pressure stage combined in the differential cylinder, while the third stage is represented by the single-acting, high-pressure cylinder on the other side. The three coolers consisting of copper serpentines are united in one common receiver placed under the floor.

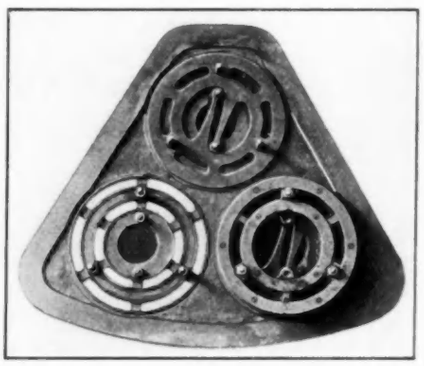


FIG. 15. SPECIAL BLOWING-ENGINE VALVES FOR REMODELING PURPOSES

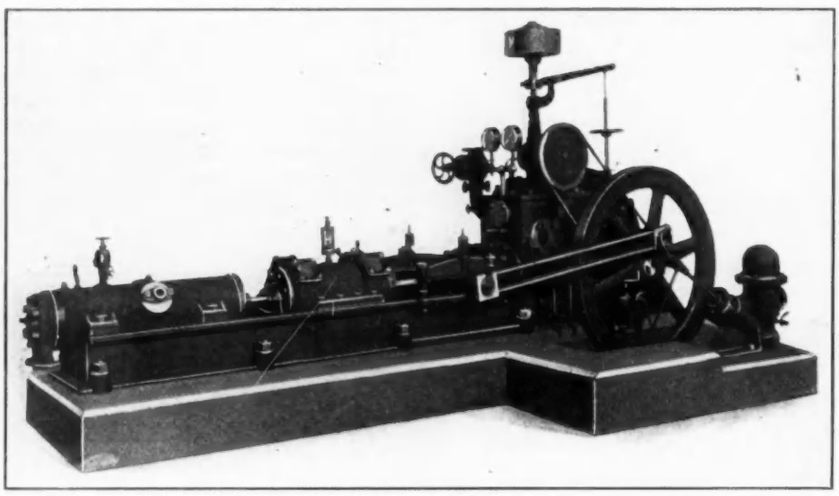


FIG. 12. A THREE-STAGE BORSIG AIR COMPRESSOR

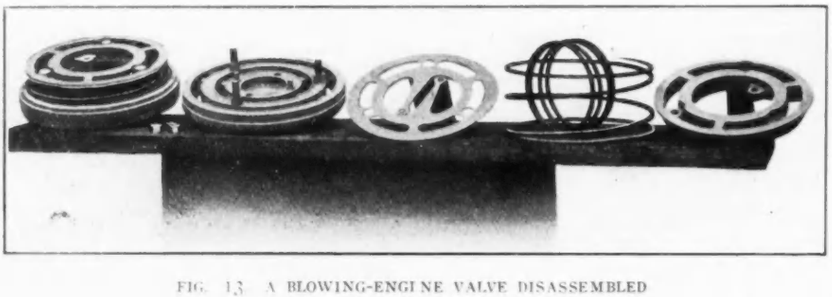


FIG. 13. A BLOWING-ENGINE VALVE DISASSEMBLED

Blowing Engines

The Borsig valve has had considerable success for engines for low pressures, for instance in blast engines. Such a valve is shown in Fig. 13. By means of these large valves a smaller number of valves may be inserted, as has been usual with blast engines, which, with regard to the security of working and accessibility is of great advantage. Besides the valve casings may be of smaller dimensions. A blast engine having a stroke of 1200 millimeters (48 inches), making 90 revolutions per minute has been continually worked for years, but not the slightest valve defect has as yet been discovered. The air diagrams, Fig. 14, were taken from this engine and show that the valve resistance is very trifling. In order to be able to obtain a higher efficiency, that is, a greater number of revolutions of blast engines of an older type which are still working with leather or felt flaps, an arrangement, as shown in Fig. 15, has been made, which allows the inserting in the segment between the plates of the cylinder covers a number of metal plates.

A Locomobile Air Compressor

Finally, Borsig has lately started a special locomobile compressor, a view of which is shown in Fig. 16. The use of compressed air is getting wider and wider

and the establishment of standard compressors to be driven by locomobiles always involves great difficulties and loss of time, thus this firm has constructed this special locomobile compressor which unites all the advantages. An engine driven by superheated steam directly coupled with a compound compressor guarantees very economical service.

This engine is built in two sizes, one

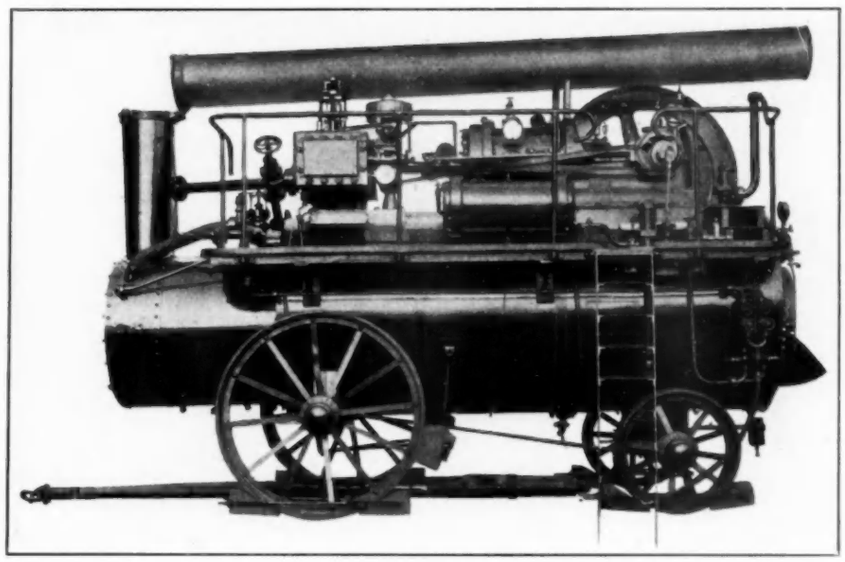


FIG. 16. A BORSIG LOCOMOBILE AIR COMPRESSOR

for a suction power of 2-3 cubic meters (55 to 80 cubic feet) per minute and the other for a suction power of 5-6 cubic meters (140 to 170 cubic feet) per minute. The dimensions of the engine are such that some power may be taken from the flywheel in order to drive machinery. In stationary works where the existing driving engines admit of no additional load, this locomobile compressor will be successfully applied in the event of compressed air being introduced. The more so as it can be erected near the place where air is used.

It is claimed by leading English experts that the dredging since 1890 of the river Mersey and its approaches has been one of the most continuously successful undertakings of that character in the history of marine engineering. The Mersey docks and harbor boards some time ago placed an order for the construction of a dredger that will be the largest and most powerful ever built. The contract provides for a vessel that can lift 10,000 tons of sand in fifty minutes and attain a speed of 10 knots an hour. The propelling machinery will be of 3500 indicated horsepower, and the dredger which is now nearing completion will have a hopper capacity of 180,000 cubic feet. Its dimensions will be as follows: Length 478 feet over all, 69 feet beam and 30 feet 7 inches in molded depth.

A Useful Adjunct to the Punch Press

By Philip Bellows

It is customary to see steel and iron plates brought to a punching machine and held in position by one, two or more helpers, while the leading man locates and punches the necessary holes. If the plate be very heavy the outer edge is supported by a chain hoist, or a wooden horse. All three of these methods are bad. The first, for the reason that it is difficult to get two or three men to act together with accuracy and precision and because it is difficult by this method to maintain a level plate; consequently many punches are broken through not getting a fair bearing on the work. The second method is open to the objection that when the weight of the plate is borne by a chain, its lateral movement has to be carefully controlled, otherwise the pendulum like action will cause it to swing away just as it has been located. The third is open to the objection that the friction between the plate and its support is so great, that the action of adjusting the plate for punching the hole is jerky and irregular and makes for poor workmanship.

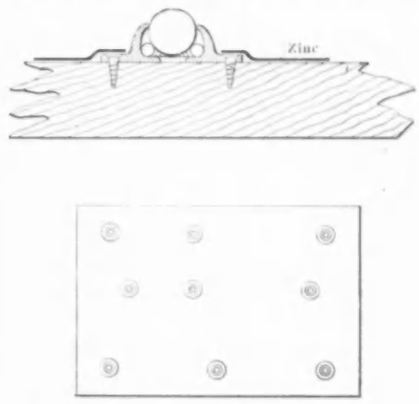


FIG. 2. DETAILS OF CENTERS FOR WORK-HOLDING TABLES

The table shown in the illustration, Fig. 1, however, overcomes these objections. Fastened to the heavy wooden top of the table, which is approximately 3 feet 6 inches by 5 feet, are some eight furniture casters of the well known, ball-bearing type. After these are in place the table is covered with sheet zinc to preserve the wood from destruction. With such a support as this, a plate weighing two or three hundred pounds can be handled easily with one hand, leaving the other

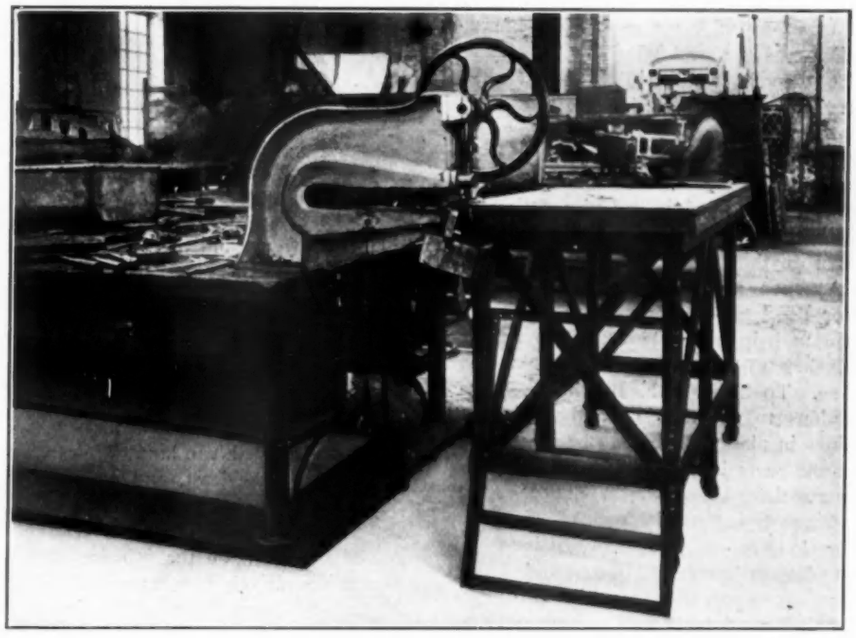


FIG. 1. A WORK-HOLDING TABLE FOR THE PUNCH PRESS

hand of the operator free to operate the punch.

Fig. 2 shows the method of attaching the casters and zinc cover to the top of the table. I would suggest that the casters on one half of the table should be spaced closer together, as shown in Fig. 3. This is in order to facilitate the handling of small plates of irregular size, so that when such a plate is being handled it shall have a fair bearing on at least three casters and will run no risk of failing to overlap the farther caster of the group.

Echoes from the Oil Country—Links of an Endless Chain

By W. Osborne

The mill had to be shut down for repairs. Some parts had been sent to a machine shop in a city some 50 miles away to have work done that could not be done at the mill. While waiting for the return of these parts the repairs had been pushed along as far as they could be, for it was a hardship for the owner to have the mill idle. While the force was a small one it had to be boarded whether working or not, and besides that there was another mill near enough to get much of the work if the work of this one was not satisfactory. It had taken much effort to get a good share of the work that was going and naturally the mill owner did not wish to have any of it get away from him.

Bill was the man who kept up repairs. The men gave him all sorts of titles, "master's mechanic" being the most common one. He looked after the proper running of the engine, although the fireman kept it oiled. He babbitted boxes when they needed it, did pipe fitting, set machinery and hunted up the trouble when anything went wrong.

As soon as the parts came from the shop Bill had to get busy with all the idle men to help him. Things did not come together as nicely as they might have done. To begin with, Bill had been too anxious to get things together and had things in place that had to be removed to get the parts just received into the places where they belonged. That took time and was trying on the temper. The help were long on energy and full of independent ideas of how to do things, and did not always pay attention to Bill's directions, and their work had to be undone and done over again.

It must be admitted that some of the work from the shop needed a little doctoring. This was not to be wondered at, as new parts had been made to replace worn out and broken ones with the parts as the only guide to sizes, and the work had been done under "rush" orders. You know what such an order is capable of doing at times.

Passing It Along

The owner received a visit from one of his customers. This customer knew his own importance and made it felt. It took all of the millowner's suavity to keep him in a reasonably good humor in addition to some big promises as to how fast the work would be gotten out, and so Bill got quite a going over after the customer had gone. After the way the customer had "bullyragged" him, Mr. Brown simply felt that he must pass it along or burst. Brown was not a man who had trained himself to self control.

Bill did not relish the calling down which he received. The men heard it and would mind it unless he made a very good defense, and Bill pointed out that the mill "would have been running ages ago if it had not been for the fact that the work from the machine shop had to be all done over again." Every defect in that work was enlarged upon and all the mistakes that had been made in the repairs were blamed on it either directly or by insinuation. Bill was a past master in the art of transferring the blame, and he had a ready command of sulphurous and ungrammatical language that was hard to reason with. Mr. Brown had his wrath divided so that some of it was turned against the machine shop. He returned to his house which also served as his office, and wrote a letter to the shop.

He related in this letter how he had been a good customer and a good friend, and would like to continue to be, but stated that the quality of the work received had been a disgrace to civilization. For the sake of old friendship he had tried to suffer in silence, but this last job had been the straw that broke the camel's back. The proper course for him would be to enter suit for damages, but the very least he could do would be to send his work to a shop where they gave proper attention to work, and this he would certainly do if he ever got such another job from them.

What the Letter Did

It was a hot and murky day when Mr. Brown's letter came to the shop. After the owner read it he called in the superintendent and handed it to him. Times were "quiet" to say the least, and it had been a question as to whether it was possible to keep all the force. The man who did most of the work on the job for Brown was a comparatively new man in the shop and had not been thoroughly tried out.

The quality of the work had not been such as to call for the man's discharge, but such a letter coming on such a day and with work so scarce in the shop had received more serious consideration than it might have done under other conditions.

This being discharged was a serious matter for Davis. He was a young man who had been maried but a short time before the dull times. The big works had reduced their force and he was one of the ones who had to look for a job. The one that he had just lost was the only one that he had been able to find. He had liked the work, and had thought that he could hold the job and give good satisfaction, and now he was out again with very little money to keep a wife while he looked for another job, and from all reports jobs were very scarce.

Mary did her best to cheer him up and suggested packing their household goods. She would go and visit her sister while he looked for work. That would make the money last longer.

Where Bill Gets His

When Mrs. Brown went to church a few Sundays after this she met Mary and her sister there. Mary had been one of her girl friends, and they had lots to say to each other, and among other things, Mary told how her husband was out of steady work so that they had been obliged to break up housekeeping. She also told how he was a first-class machinist, and painted up his virtues as only a good wife can. Mrs. Brown was duly impressed.

Things had not been running very smoothly at the mill. With good times and fine weather, so that the spirits and the nerves of everybody were in good shape, they might have been better, but now everybody seemed on edge.

Mr. Brown came home on Monday in a bad humor; even in normal times Monday seems to be the most trying day of the week on the temper, and let it be known, "If I knew where to get another man to look after the machinery I would drop that Bill so quick that it would make his head swim."

Mrs. Brown did not know much about Bill's ability, or about the machinery in the mill, but she did know Mary and like her, and she brought up the availability of Mr. Davis in such a manner that she was told to see Mary, and if Davis thought he could do the work and would be willing to come and stay at the price Bill was getting, to have him come. He came.

Bill is now working on the construction gang on the railroad. Davis has to go to the machine shop occasionally to have work done. Some of it is new work, for the mill is growing. The superintendent likes him, and often thinks he was a little hasty in letting him go.

Brown is pleased with the way things are going at the mill.

Mary is keeping house near her friend, Mrs. Brown.

* * * * * * *

Abusing Machinery

The superintendent of a company that made good machinery in a careful way and under a good system of shop management, sat with a letter in his hand. If all that this letter said was true he was a failure, and not fit to hold the position he occupied. The letter had come from a company which had bought one of their machines a short time ago. It had been sold in competition with other makes of machines. It was not the lowest in price,

but had won on account of the supposition that it was a superior machine. Judging from the letter the purchaser had not found it even passably good. While the letter did not go into details as to the particular points of trouble, yet the generalities were so sweeping that there must be trouble some place to have started the disturbance. A man who has bought a new machine and finds that it is making money for him does not write that kind of a letter.

The superintendent knew that with the most skilfully-planned system and with the most carefully selected shop force things will sometimes get out that are not as they should be; experience had also shown him that a machine will sometimes be put to a use that is different from anything the designer had imagined, and will develop very unexpected weaknesses in such service, and things sometimes happen to a machine after it leaves the manufacturer and before it reaches the customer that hurt it, but which may not be recognized as having been done, or it may be a new sort of machine to the customer, and he does not know what to reasonably expect.

Finding the Trouble

All of these things and a lot more were revolved in the mind of the superintendent. The outcome of his thinking was that he took a train and went to where the machine was in use. He was a stranger in the place, which was a long distance away, and had to inquire his way to the works which he was seeking. His approach brought him to the rear of them, and as there were no "No Admittance" signs to be seen he started through them, his thought being that it would be the quickest way to find and get to the office.

He had not gone far until he saw the machine which he had built. He had to look it over carefully to be sure that it was a new machine.

Apparently it had been abused in every way that a machine could be abused.

It did not take a very keen observer to see that it was not getting any worse usage than the rest of the machinery, but the strong point about some of it was that it was built more with an eye for standing rough usage than for getting out work. The work being done was rough, and after developments showed that it was sold at the lowest market price for that kind of stuff. Their customers were the kind of people who like to buy cheap regardless of quality.

The superintendent finished his observations without seeing anyone who appeared to be in authority. He went out the way he had come in and went around the works and came to the front door of the office. He introduced himself as being there to see about a settlement for the machine, but did not state his official position. The manager at once opened up on him and gave the machine a very hard name, winding up with the statement that a very substantial reduction would have to be made in the price, or the machine would not be kept, intimating, also, that if the machine was thrown out it would go a long way toward keeping others out of that section of the country. Everything was blamed on the machine.

Putting It Up to the Manager

Expressing surprise that there should be any trouble with such a machine if it was used properly, the superintendent requested that the manager go with him and show him the machine. The manager thought that he was too busy to spare the time, but the superintendent persisted, and they went down through the factory to where it stood, and after looking around for a few minutes returned to the office, and to the manager's private room.

"I am the superintendent of our works, and that machine was built under my management. Had we known the kind of abuse you allow the machinery in your charge to get the machine would never have been sent to you. As it is, you will have to pay in full for the machine. I don't think our salesman was ever inside of your factory, or he would never have tried to sell you the machine."

There was more talk, and some of it was very plain, but the manager maintained that the machine was "no good."

The superintendent went to the bank and found who the owners of the factory were. The banker was one of them, and the others were not far away. They were called in and listened to the story of the superintendent. They were not making the money that they thought they should, but did not know why. They were business men who knew nothing about factories from the inside, and had depended entirely upon the manager.

They accepted the invitation of the superintendent to go with him to where they could see some well managed factories where good work was turned out. The upshot of the matter was that they put in a new manager who had better ideas about shop management.

The new manager never found occasion to complain that any of the machines furnished were not properly built.

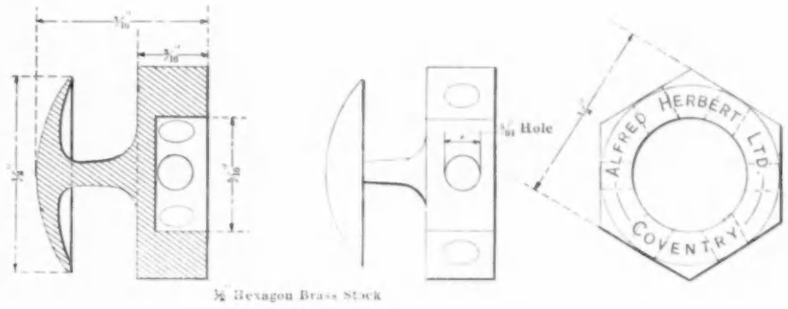
An Interesting Automatic Screw Machine Job

By J. W. Carrel

The sketch shows an interesting piece of work produced by an automatic screw machine exhibited at the Franco-British exposition, London, by Alfred Herbert, Ltd., Coventry, England. The piece is shown double size in the sketch, the actual proportions being denoted by the approximate dimensions on the different views.

The work is a brass model of the Herbert hexagon turret and is produced at the exposition as a souvenir which the visitor may insert in a button-hole, if he so desires. Half-inch hexagon stock is used and the piece is finished complete, with undercut at the rear, crossholes drilled and the firm's name on the turret face, in 35 seconds.

The cross-drilling operation is the most ingenious of the series performed in the production of this souvenir. After the



AN AUTOMATIC SCREW MACHINE, JOB SHOWN DOUBLE SIZE

5/16 hole has been drilled in the front end, the turret brings into position a device carrying about its periphery six drill spindles radially disposed in a vertical plane. This multiple-spindle drilling attachment is open at the front to enable it to pass over the work to the required point, where it is held against further longitudinal movement while the six drills are fed toward the center of the work by mechanism operating simultaneously upon all of the spindles. Each drill carries a small end facing tool and the six faces of the miniature turret are just touched and shaved smoothly by the facing cutters before the drills are withdrawn.

The forming of the convex surface at the rear end is, of course, a simple matter; the inner concave surface, however, involves an undercutting process in which a tool of the necessary form is fed into the work and then given a lateral movement toward the spindle, producing a nicely finished surface. The imprint on the face of the souvenir is made with a stamp carried by the turret and pressed squarely against the work.

Portable Oxy-Acetylene Welding Outfit

Self-contained Autogeneous Welding Apparatus Mounted on a Hand Truck. Materials Used and Methods of Generating Gases. Work Done

BY E. F. LAKE

The autogenous welding of metals, which is accomplished by applying a hot blast to them, in the open air, until they are melted and run together has been practiced for many years, but it was merely a laboratory experiment until a very few years ago, except with the metals of a very low fusion point.

For the metals of a higher fusion point, such as iron and steel, the method most generally used for obtaining the high degree of heat necessary in the blast was to combine two gases, under pressure, in a burner. Oxygen and acetylene gas were the two gases most generally used, but oxygen and hydrogen were used by many.

The oxygen was usually manufactured and stored, at a high pressure, in steel tanks, called bottles. These were shipped to the consumers and the oxygen drawn off, in using, until the pressure became so low it was not effective, and then the bottles were shipped back to be recharged.

Sometimes the pressure in these bottles was as high as 2000 pounds per square inch and the oxygen was drawn off until the pressure went below 15 pounds, after which it was too weak to be used. This high pressure made a very dangerous explosive, as it is more power than is behind the shot of the big guns in the navy, and many lives were lost and cripples made by the explosion of these bottles. The latest life to be sacrificed was that of a prominent oxygen manufacturer in Buffalo, N. Y.

This process is still used in oxy-acetylene welding apparatus and for some classes of work is reasonably cheap, but the labor and chemicals used in making the gas and the freight rates for shipping the tanks are so costly that in many places, and for many kinds of work, welding, commercially, could not be done successfully. Up to about three years ago the apparatus for handling and conveying these gases was crude, heavy and expensive and this also barred it from commercial applications.

New Apparatus and Chemicals

Within the three years that it has been experimented with and used in this country great improvements have been made in the apparatus so that now it is simple and easy to manufacture and operate and the new chemicals, which have been brought into use for the manufacture of the oxygen, are so great an improvement that the oxygen can be manufactured while it is being used. This does away with the danger to life and limb caused by the high-pressure tanks, as from 15 to 30 pounds pressure is all that is ever required in the oxygen tank and this can easily be held by a sheet-metal tank and would not be dangerous if the tank did explode from any cause.

The acetylene gas has been easily and cheaply made for a long time, and the apparatus has been very simple to make, but this has also been improved on, until the carbide is placed in a basket in a tank, the tank sealed, and the gas is made and regulated automatically until the carbide is all used up, after which the tank is opened and another charge of carbide put in.

One of the simplest outfits yet brought out for autogenous welding with oxygen and acetylene is that shown in Fig. 1. This was the result of a year's experimental work by Mr. Sanford and it is manufactured by the F. C. Sanford Manufacturing Company, Bridgeport, Conn., U. S. A.

This entire outfit is mounted on a hand truck, and can be wheeled by one man to any place where work is to be done. It is fully self-contained and thoroughly automatic in every detail. It produces the gases as desired by merely charging the machine with chemicals which are in powdered and lump form.

Mr. Sanford does not believe in secret compounds and gives with the machine a list of chemicals to be used in making the gases. These can be bought in any city and easily mixed by the users.

FIG. 1. PORTABLE OXY-ACETYLENE WELDING OUTFIT OF F. C. SANFORD MANUFACTURING COMPANY

Making the Gases

The acetylene gas is generated in the rear tank by the most simple, unique and thoroughly automatic generator yet produced. As no valve has yet been made that will hold acetylene gas for any length of time, valves are entirely done away with in this generator. Weights, shim wheels, chains, reservoirs, springs, gears and all other appliances, that are

continually getting out of order and causing trouble, have also been abolished and yet the generator can be set for any pressure and the same maintained during the operation of the machine.

The long-followed custom of using a carbide that will pass through a given mesh, usually one inch, or smaller, has also been abandoned and the rock or lump carbide used. This effects a saving in two ways; one being that the lump carbide is cheaper than that which has been broken and passed through a screen, and the other is that the finer the carbide the more it will air-slacken and lose in efficiency, which means that a larger volume of acetylene gas can be obtained from a given amount of carbide in the rock form, than from that which is finer grained.

The oxygen is generated from a powder that is composed of a mixture of black oxide of manganese and chloride of potash. This powder is placed in horizontal tubes, or cylinders, seen on the front of the truck platform, and there it is heated or baked by the six Bunsen burners, shown under the cylinders. These burners burn acetylene gas that is piped from the rear tank.

This operation causes oxygen to form and pass from the cylinders, through pipes, into the steel tank in the middle of the truck. When it first enters this tank it passes through a wet scrubber or cleansing tower, and when drawn out for use the oxygen passes through a dry scrubber, which is also located inside the tank, to exclude all dampness and foreign matter. It then passes through a pressure-reducing valve, shown on the front of the tank, and through the hose to the blowpipe.

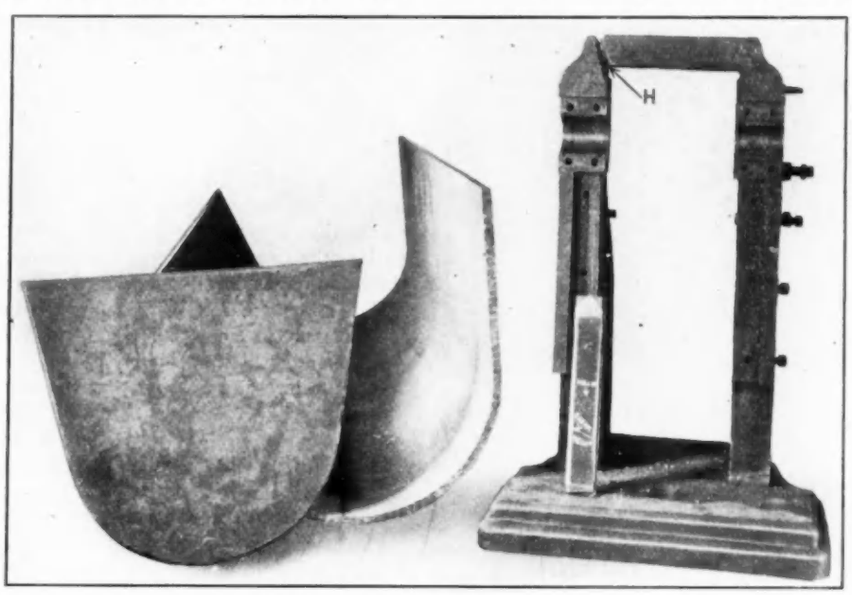


FIG. 2. SHEET STEEL COVER AND PRESS FRAME READY TO WELD

By this method oxygen is generated for 2½ cents per cubic foot, which costs from 6 to 10 cents when produced by the old machines or sold in steel bottles. The cost of the powder for generating the oxygen for this apparatus is about 8 cents per pound and the ingredients of which it is composed can be purchased in any city. One charge of powder will generate enough oxygen to work the apparatus for 10 hours on thin sheet steel; two or three charges is enough to work 10 hours on metal ¼ inch thick and four or five charges will weld metal ½ inch thick for the same length of time.

Safety Appliances

When generation of the oxygen is started in the front cylinders there would be danger of an explosion, or blowout, if the valve between the cylinders and tank was not opened to allow it to flow into the tank. This danger of explosion is entirely obviated by using a three-way valve at this point, which allows the oxygen, generated in the cylinders, to escape into the air when the valve is not turned on to make it flow into the tank.

As the Casualties and Fire Insurance Company insists on a safety valve being

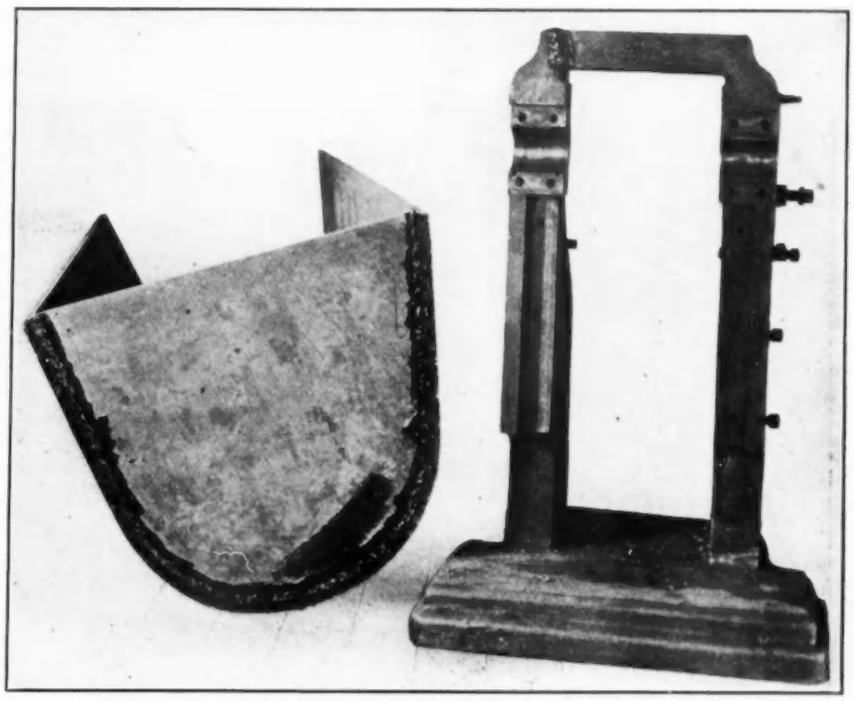


FIG. 3. THE PIECES SHOWN IN FIG. 2 AFTER WELDING WITH THE PORTABLE OUTFIT

placed on all acetylene generators, and one could not be found that would hold the gas for any length of time, or that would not stick, or that could be relied on to open at a given pressure, it was found necessary to manufacture one. This was done by producing one with a siphon and bulb filled with mercury. By making the siphon act through the mercury it was found to be positive on all occasions. Another interesting feature for the insurance companies is that, being portable, it can be run into the back yard or out in the street to be recharged.

On any oxy-acetylene apparatus there is danger of back-firing causing an explosion, unless it is properly constructed. The back-fire has many causes, such as the blowpipe becoming clogged with dirt, the gases not being properly mixed, or the parts becoming overheated. An absolute protection from explosions caused by this back-firing is obtained by locating two fire arresters, so they are in connection with the hose, and a valve that scatters the blow.

The flame from a back-fire would travel through the hose back to the pipe, and follow this to the valve *A*, which contains screens to scatter it. What passed this valve would enter the water tank *B*, and if any should back up from this it would pass out of the open pipe at *C*. From

the water tank *B* what might be left of the flame, if any, would pass through the screened valve *D* and into the muffler *E* where the flame would be arrested and the gas could enter the acetylene tank at *F*; the muffler at *E* being a positive check through which not a thing can return.

The safety appliances make this welding apparatus absolutely safe; its construction is so simple and compact that the average workman can learn to operate it with a little experience; and the cost of welding with it is so low that there are many classes of work to which it can be applied.

FIG. 4. USING THE WELDING OUTFIT ON A REPAIR JOB AT A JAIL

Some Welding Operations

Some of the work which this welding outfit is capable of doing is shown in Figs. 2 and 3. On the right of Fig. 2 is shown a frame casting of a press, which broke at *H*. The metal at this point was solid and 4 inches square. A slot about 1 inch wide and 1 inch deep was chipped out, following the break, all around the section and new metal was then fused with the old, by the aid of this welding apparatus and common salt for a flux.

Mr. Sanford has experimented with many kinds of fluxes, some of which have cost as high as $16 per pound, and he has found that common salt is as good as any for welding cast iron with the oxy-acetylene blowpipe.

This is the thickest cast-iron weld that has come under my notice and the casting was made as good as new without destroying any of the machined surfaces. The weld just as it was completed is shown in Fig. 3.

The steel cover, shown to the left of both Figs. 2 and 3, was 10 feet long and made of metal 1 inch thick. This was also welded with the portable outfit shown in Fig. 1, and the completed weld is shown in Fig. 3.

The piece of sheet steel, shown fastened to the white paper and standing up against the press frame was a sheet 1/10 inch thick and 2 inches wide, that was welded, near its center, with this outfit. After being welded the sheet was put in a tensile testing machine and pulled. As will be seen in the half-tone it broke some distance from the weld and stood a pull of 9830 pounds before breaking, which is nearly 50,000 pounds per square inch. This shows that the metal at the weld was stronger than where it broke. It also shows that the metal on either side of the weld was not weakened from overheating as this would take place close to the weld and the place that broke would be cool enough to hold the hand on while making the weld shown.

A striking illustration of the convenience of this portable apparatus is presented in Fig. 4 which shows the outfit on a truck in front of a jail where it was recently employed for welding the broken frame of a shoe machine. As shown, the welding outfit was simply drawn up near the building and the hose was then passed through the netting and between the bars guarding the window, and the welding operation performed as handily as if the outfit and the work had been side by side.

The entire outfit has been covered by patents, and besides manufacturing it for sale the F. C. Sanford Manufacturing Company, of Bridgeport, Conn., is prepared to do any kind of autogenous welding that is sent to it. While the samples shown are steel and iron, the apparatus will also weld copper, brass, aluminum and other metals.

Device for Testing Squares

By C. L. Libby*

Some years ago while I was with the Ludwig Loewe Company, of Berlin, Germany, we had in use through the plant a large number of try-squares, varying from 3 to 36 inches. These squares were all furnished to the various departments by the company and while the squares were new there was no particular trouble. But after a while I noticed that the scraping was taking more time on certain pieces than it ought to and upon investigation the scraper foreman complained that the pieces were not planed square, and for that reason it took more time. The planer foreman being informed of the complaint, he immediately brought out his pet-square and showed that the work was correct. Then we compared the square with one in the inspection department and found that neither of them was correct as compared with the inspector's square. This discrepancy led me to get up a device for testing squares, as illustrated in the accompanying drawings.

A, Figs. 1 and 2, represents a narrow surface plate, having a projection or extension about midway of its length to carry the upright arm *B*, the upper end of which is bored out to form a bearing for the stud, which carries lever or pendulum *C*, at the lower end of which is a stud (see Fig. 2), which projects in between the two pins *D* and *E*. The pin *D*

*Superintendent, International Machine Tool Company.

pushes the stud over against pin *E* by means of a stiff spring, as shown.

The pins *D*, *D'*, *D''* are beveled off at an angle of 45 degrees, where they come together, so that by turning the screw *F* to the right the pins *D''*, *D'*, *D* are pushed forward and force the lever *C* to the right against the resistance of spring *G*. If the screw is turned to the left, the pins *D*, *D'*, *D''* will be pushed back by means of the spring, and lever *C* will swing to the left.

On the front of this lever *C* is attached a double-edged straight-edge, the two edges being as nearly parallel as it is possible to make them. Attached to lever *C* are two mirrors, arranged directly back of the edge of the straight-edge. Off to the left and right are arranged a series of incandescent lights in a reflector, which extends forward at the front side to protect the operator from the light. The mirror is arranged to turn on its axis so that a ray of light may be projected directly past the edge of the straight-edge.

Now when the square is placed in position as at *L*, by means of the screw *F* the straight-edge is brought into position so that its edge exactly coincides with the square, so as to shut out the light and the square is shifted over to position *M*. Now if the square is out of true, there will be an opening, either at the upper or lower end of the blade, which will be equal to twice the amount of the error in the square. By loosening the screws at the front of the straight-edge the straight-edge can be raised so that the heel of the square will pass under, thus enabling one to test the inside of the blade. The test should be made in a dark room to get the best results.

After the device was completed we brought all the squares in and had them tested, and of the squares in the shop there was not one that did not have a perceptible error. The only one in which we did not find a perceptible error was a new 18-inch Brown & Sharpe hardened and ground square.

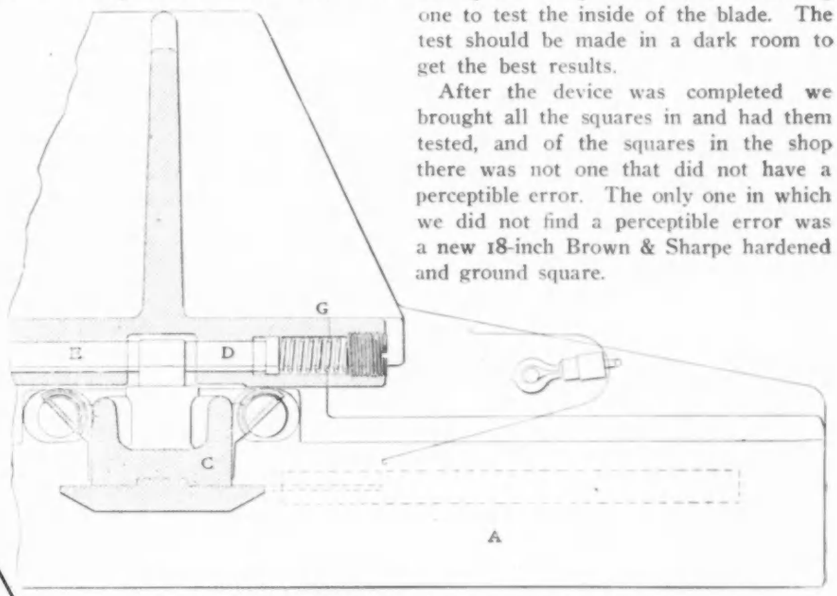


FIG. 2. SECTION THROUGH STRAIGHT-EDGE MIRROR, ETC.

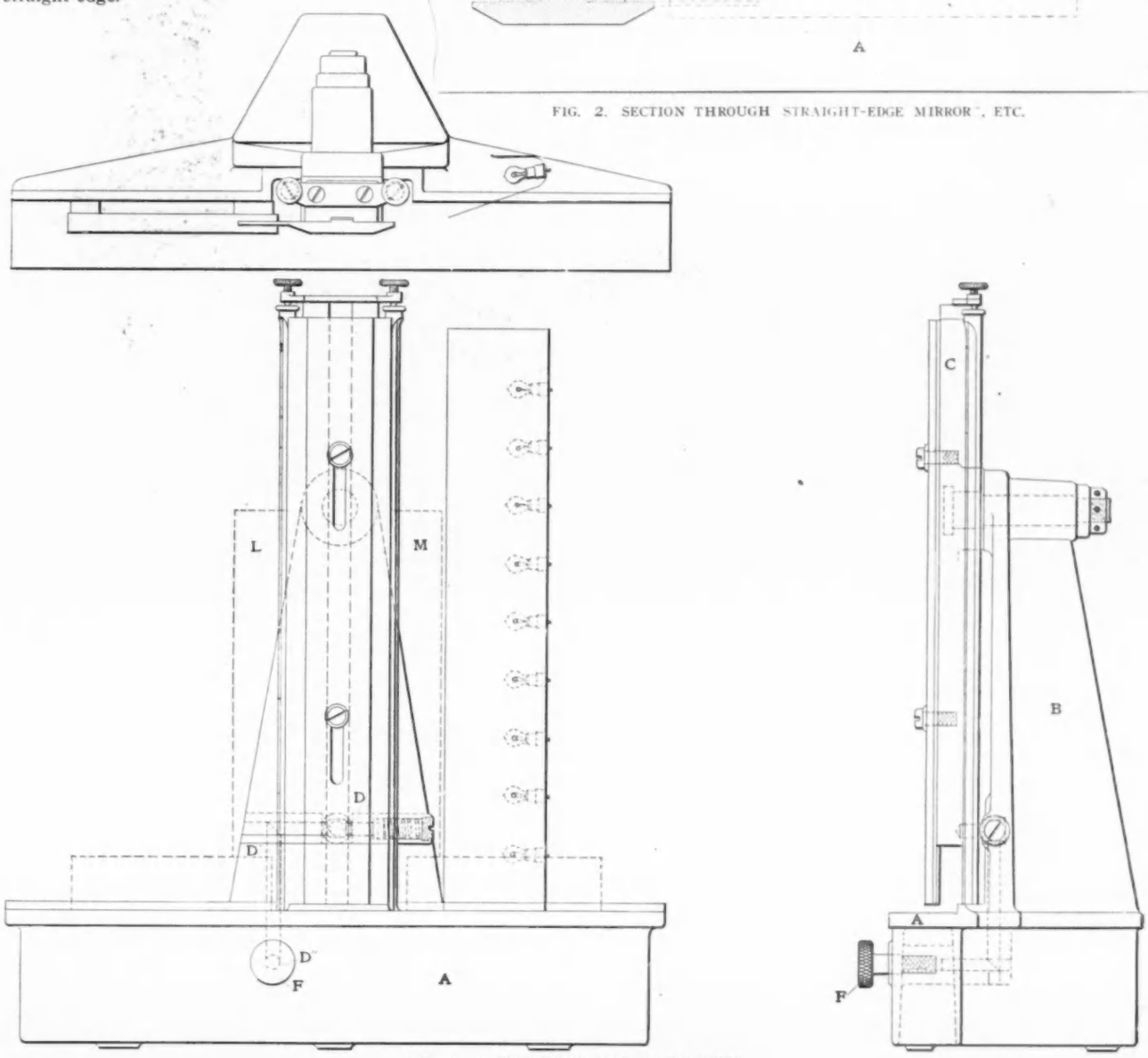


FIG. 1. A DEVICE FOR TESTING SQUARES

A Large Gear-cutting Machine

The gear cutter shown in the accompanying illustrations was built for the Vulcan Iron Works, of Wilkes-Barre, Penn., by the Newton Machine Tool Works, Inc., of Philadelphia, and is being run day and night to the entire satisfaction of all concerned. It is of the vertical planer or slotter type, the tooth form being held in the brackets *A* and *B*, Fig. 1. These brackets are run in against a stop to the right point, according to which side of the tooth is being cut and the guiding roller is forced against them by a friction clutch as will be described later.

The tooth to be cut is first laid out in the drawing room and a sheet-metal templet made for both the tooth and the space. The pitch line and the bottom of the tooth are both marked, while the gear wheel is on the boring mill, then the teeth are laid out on the blank with the templet. The teeth are then gashed out with a plain tool to the bottom of the space, then the regular tool put in place and the tooth roughed to within a thirty-second of the line, after which the finishing tool splits the line.

The indexing mechanism is shown in the foreground of Fig. 2. The lever *C* controls the stop or lock, and to move the work one tooth, the operator raises this lever, starts the indexing motor and lets the worm-indexing wheel make one complete turn around to the locking point. The change gears *D* at the right transmit the motion to the indexing worm and wheel under the table through shaft *E* and turn the work just one tooth. Slight adjustments of the table when resetting work are accomplished by the small worm *F*.

The indexing table under the work is 84½ inches in diameter, the worm wheel beneath is 79 inches in diameter, being split and moved to four different positions in the cutting in order to insure its accuracy. The spindle is 16 inches in diameter, with a bearing 33½ inches long; table has two bearings, one 25 and the other 67½ inches, both being outside diameters 4 inches wide, so that it is rigidly supported both at the periphery and at the center. A taper hole 8 inches in diameter at the big end and 18 inches long is provided for mandrels with through bolts for holding the arbor in place. In addition, the table is supplied with six T-slots which are used for clamping and driving the gear blanks. The table acts as a cover for the worm and worm wheel, and is accurately fitted into the base to prevent any dirt working down into the gear.

The box carrying the indexing worm wheel is 90 inches and is bolted to the base on which the upright is mounted. This base is 48 inches wide and 13 feet long over all, and in addition to bolting, is keyed for maintaining alinement to the indexing worm box. On this base is mounted an upright of one of the standard 48-inch portable slotting machines of this firm. This upright is guided on the base by means of keys and is adjustable by rack and pinion and when set to the required position is clamped in place by six 1½-inch bolts.

To the upright is fitted the saddle carrying the tool slide which has an automatic cross-feed of 39 inches in either direction and the tool post has an automatic in-and-out feed of 6 inches. Just below the bearing for the tool slide is a separate bearing provided for the former holders and on each side of the tool slide are fitted rollers which actuate against the formers.

In operation the tooth to be cut is set central with the upright by a center line on the base and the tool is set for approximately the pitch line of the tooth to be cut. The roller is then set for the pitch line of the former which is indicated by a center line. The head is then drawn back, the amount of metal to be removed is determined on and the feed set and the cut started. In order that the tool will follow the former, a positive in-and-out feed is supplied and to the cross-feed is applied a friction so that when the roller is to be solid against the former, the friction will slip and each time the tool feeds outward it overfeeds and so hugs the former in all its varying positions. The rate of feed is controlled by adjustable dogs on the side of the upright. The

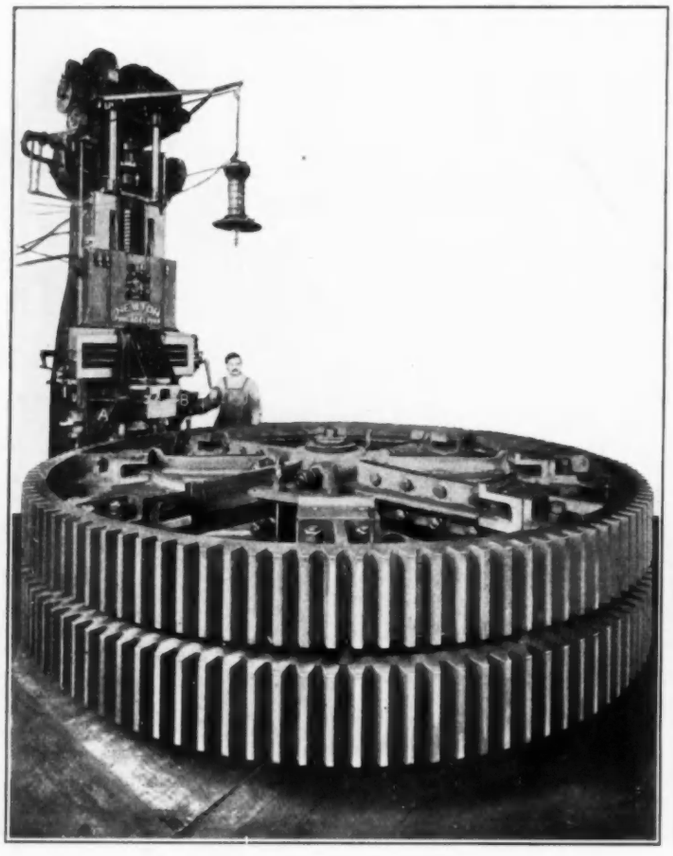


FIG. 1. FRONT OF GEAR CUTTER

FIG. 2. INDEXING MECHANISM OF GEAR CUTTER

tool apron is made to swivel so as to give clearance to the tool on reversing stroke.

The cutter slide or ram is 66 inches long over all and has a total bearing of 30 inches on the upright, each individual bearing being 7½ inches wide. This cutter slide is operated by a screw 4½ inches in diameter with a 3-inch pitch, double lead, square thread, the nut being made of bronze, and is split to compensate for wear. The screw is carried in tension at both ends with thrust bearings which are incased and run in oil.

The drive is by means of a 10-horsepower 3 to 1 variable-speed motor, which is fitted with a flywheel to overcome the shock of the reverse and is operated through and controlled by a pneumatic clutch which gives the reverse motion to the cutter slide, the reverse being 2 to 1 to the cutting stroke. The cutting stroke is figured from 20 to 60 feet per minute. The operating screw is clutched to the main driving gear and cutter slide is fitted with dogs so as to disengage this clutch at the limit positions of the stroke to prevent the slide from jamming at either end in case of an accident. The cutter slide is counterweighted, the weight running in guides inside of the upright. The reversing dogs are on the opposite side of the machine from the indexing arrangement and are adjustable for any position up to the maximum stroke of 48 inches, but the controlling levers are carried on both sides of the upright so that the operator can control the machine from either side.

The indexing mechanism of the machine is mounted on a separate bracket bolted to the side of the main base and is operated by a 5-horsepower series-wound motor, reducing through a worm and worm wheel. It is supplied with a friction so that when plunger engages, indexing friction mechanism stops and the friction slips. Change gears are supplied to index for gears from 40 to 250 teeth. The capacity of the machine is 48-inch stroke for the face of gears up to and including 20 feet in diameter.

The gears are 11 feet 10⅝ inches pitch diameter, 12-inch face, separated by 4-inch pieces so that the stroke of machine in this operation was 30 inches. The gears each contain 128 teeth of 3½-inch pitch. The time required to finish these two gears, which are steel castings, was 128 hours. This is the first work put on the machine and it is expected that better results will be obtained after the operator has become more used to it. This figures out at one hour per tooth for two gears, or ½ hour for one tooth for each gear, which is considered exceptionally good time considering the fact that the gear was cast steel and the tooth of coarse pitch.

We are advised that no inaccuracy in testing out these gears was discovered and in the makers' test of the machine in their own shop, with a transit on a 26-foot radius, the greatest inaccuracy to be found was 1/32 inch. This would amount to 0.006 inch per foot in the diameter of the gear, but as a matter of fact this inaccuracy only shows on certain points. In the total circle it showed absolutely correct, but there would be a possibility of certain teeth being slightly thick or thin. It is very rare, however, that a commercial gear is cut to a closer accuracy than 0.006 inch from tooth to tooth, the total circle being true and in the shop test over 60 per cent. of the indexing showed absolutely true from tooth to tooth, the additional 40 per cent. showing plus or minus.

The Natural Born Mechanic

By Con Wise

I ran across an old friend of mine the other day. He was just the same old boy as when I first knew him in school. Then he had a little shop in the top of his father's barn. It took so much of his time to keep his shop cluttered up that he had no time left for study, so he dropped out before the rest of us went to Tech. Said he was "glad of it; didn't know what good it would do for him to study any more; what a fellow needed was practice; theory was all bosh anyway." He moved his lathe and small tools into a basement, bought a little second-hand engine and boiler and hung out a sign, "Jobbing and Electrical Expert."

To be sure the extent of his electrical experience was in drawing sparks off the main belt, but he bought a set of castings and directions and started to build a dynamo. He needed it to light the shop with. When he finished it was really a nice job. It was nicely fitted, the bearings were free and without shake, the commutator ran true as a die, but when it was up to speed it nearly shook the building down. He took out the armature and rigged up balancing ways. It stood equally well in any position. In an incipient stage of nervous prostration he got one of his Tech chums to help him out, and heard for the first time about a running balance. Then he tore down the armature and trued up the headers smooth, balanced each part separately, turned out the inside of the pulley and built it up again.

Then it ran like a charm, all but the electricity. He rigged up a battery to excite the fields, but all he could get was a little spark at the brushes. Once more the Tech fellow came down, but even he had to stop and think a bit. Finally he borrowed a magneto and discovered that the armature was all short circuits. My friend then admitted that he did not have any mica to put between the commutator segments, so he used some sheet asbestos that he had left over from a gasolene-engine job, and the bars were made of cast brass. "Why not, all they are for is for the brushes to rub on." Of course, the only natural thing happened. The brass burred over the asbestos and the commutator was just as good as solid. A couple of days digging with a scratch awl took out the burs and the thing ran all right except that the commutator wires flew out occasionally.

He was then fully fledged and changed his sign to "Electrical Engineer." He took a contract to light a small shop where 50 lights were wanted. Ten to a horsepower was the standard thing then. The proprietor said his engine was ten horsepower and he knew he was not using five to run the place. The dynamo was built and with the experience acquired it ran the first time trying. It was sent over and belted up and started, just merely started. It turned out that 40 pounds of boiler pressure was needed to carry the shop; it took 50 to drive the dynamo when no lights were on and 80 to drive the lights. If there was 80 pounds pressure when the lights were not on, the engine would run away ahead of the governor (?), so they had to stand by and watch the steam gage about dusk. Then there was a flare up on the lights every few minutes till they began to burn out and then it would die out. This was just a machine that started hard and then ran easy and then stopped at varying periods. The cure was a flywheel, the old one being a worn-out grindstone. The new flywheel was a great success, in fact a howling success. Then they rebabbited the boxes and straightened the old crank shaft and everything was lovely till the boiler inspector came along and made them cut down the pressure to 50 pounds.

That was 20 years ago. The other day I found him in a shop just over the edge of civilization, living in the shop attic and doing job work. "Busy?" "Head-over-heels in work when everywhere else shops were shut down." "How do you get the work?" "Just take it cheap, dirt cheap; way under anyone else." He was working like a slave too; losing money every day on every man in the shop and working hard enough himself to make good his losses and barely live himself. Living, if you can call it that; existing is better; just hoping that the next job will be a bonanza; always so afraid that he would not get the next job that he cut the price to the quick; always lacking the common sense to foresee the difficulties in his jobs.

If anyone wants to hire a natural-born mechanic for five dollars a day, a man that can earn $10 if watched closely by a 20-dollar-a-day man and not earn 30 cents if left alone, I can tell him just where to get his man. But he will have to put bars across the windows, lock the door and search the shop every time he comes in, or he will smuggle in so much work of his own to do that he will forget all about his employer.

Suction Gas Producer Power for Factories

Gas Power Saves from 1-2 to 3-4 of the Coal Required for Steam Power—It Is Coming Rapidly into Use in American Factories

BY L. P. TOLMAN

Probably no invention has ever come into public favor in so short a time as the suction-gas producer. In 1895 Benier built in France what is believed to be the first practical producer of this kind. This apparatus was a success as soon as the necessary changes had been made in the gas engine to adapt it to the suction treatment.

Its growth in Europe has been much more rapid than in this country. As early as the year 1904 it is estimated that there were over 10,000 suction-gas-power plants in Germany alone. Today it is estimated that there are over 500 producer-gas-power plants in this country, having an aggregate of 150,000 horsepower. Of these about 85 per cent. are of the suction type, and 15 per cent. of the pressure type. The suction plants average approximately 100 horsepower each, while the pressure plants are usually built in sizes larger than 1000 horsepower each.

Waste with Steam and Producer-gas Power

The enormous heat waste in steam-power plants is well known. In small plants the total amount of energy utilized is often not over 2 or 3 per cent. of the total. In other words, 95 per cent. or more of the energy of the coal goes to waste as smoke through the chimney, exhaust from the engine, heat radiation, etc.

With a well designed suction-gas-producer power plant an average of 18 per cent. of the total energy of the fuel is converted into useful work. According to conditions this percentage may vary between 15 and 22½ per cent. This means that a suction-gas producer plant uses only from ½ to ¼ as much coal for a given amount of power as a steam plant.

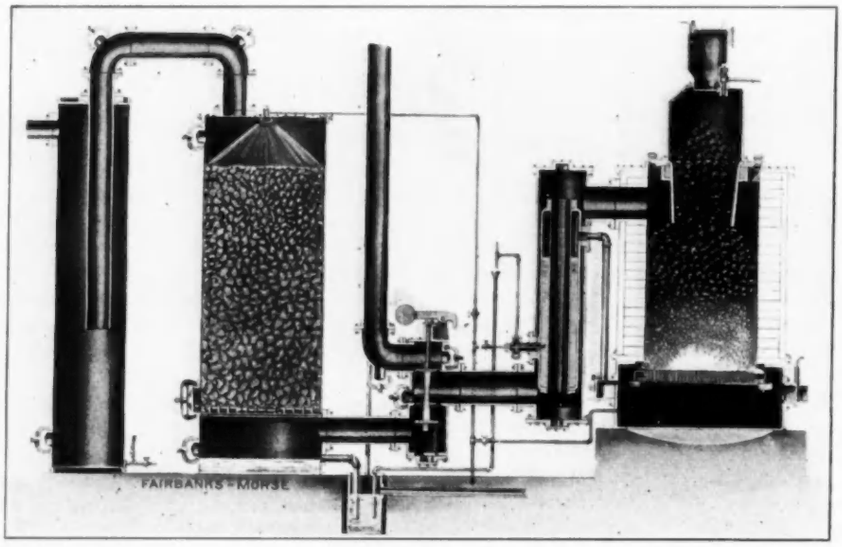


FIG. 2. SECTIONAL VIEW OF 150-HORSEPOWER SUCTION GAS PRODUCER

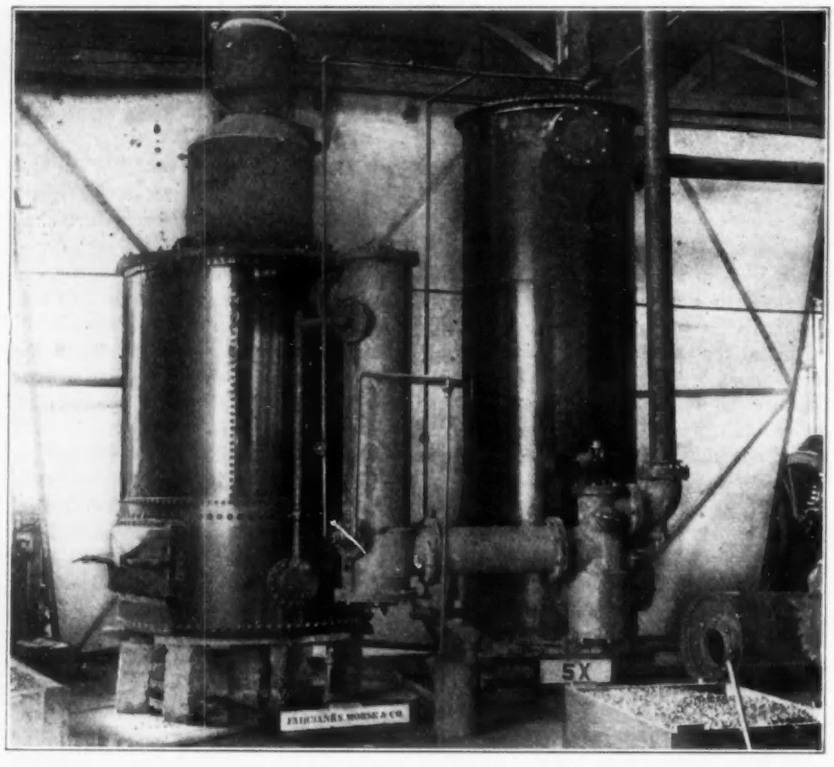


FIG. 1. SUCTION GAS PRODUCER 100-HORSEPOWER AND LARGER

Government Tests

From the summary of results obtained from a long series of tests made by the United States Geological Survey at St. Louis, the fuel consumption in pressure-type producer plants varied from 1.18 to 3.47 pounds per brake horsepower per hour. The average was approximately 1.75 pounds. The average consumption with the Corliss steam plant was found to be approximately 4.5 pounds, using similar fuel. With lignite the consumption in pressure-producer plants was from 1.95 to 3.47 pounds. The average of five samples actually figured 2.60 pounds. With the Corliss steam plant using lignite the average consumption of "coal as fired" was approximately 7 pounds.

While most of the above tests were on bituminous coal, which cannot be used advantageously in a suction producer, yet the consumption of anthracite in the latter is usually less than as stated for bituminous coal in pressure-type producers; probably due to the fact that there is less resistance to the flow of gas in the suction type. For example, tests on lignite in a suction producer commonly show a consumption of 2 to 2.25 pounds; whereas

from the five lignite tests at St. Louis the average is 2.60 pounds in a pressure-producer plant.

Advantages of Suction-gas Producer Power

In addition to the thermal efficiency that has just been discussed, there are several distinct advantages for suction-gas-producer power. They may briefly be summed up as simplicity, absolute safety, absence of smoke stacks and smoke, reduction of the amount of coal to be handled and stored, ease in starting and reduction of standover losses.

The advantage of safety can be well emphasized. There is no danger from explosion or from fire. The apparatus is absolutely safe even in the hands of men who have little mechanical training, and the many plants which are in continuous operation, some of them 20 and even 24 hours a day, indicate that they are thoroughly reliable and will stand hard, every-day usage.

Boiler insurance is unnecessary, and the dangers encountered with steam boilers are entirely avoided. The complete engine and producer plant is almost entirely automatic in operation and requires but very little attention.

The advantage in the decrease of standover losses is well worthy of notice. This loss in a suction producer amounts to about one-third as much as in a steam boiler. In other words, where the standover loss in the steam plant for 14 hours amounts to from 600 to 800 pounds of coal, or perhaps more, with a suction-producer plant of the same horsepower this loss would not exceed 200 pounds.

Suction-gas Producers

Fig. 1 illustrates in an exterior view, and Fig. 2 in section, a Fairbanks-Morse anthracite suction-gas producer. Coal is admitted to the producer through a hopper at the top. This has a double closure so that fuel can be introduced without at the same time admitting air. In the process of partial combustion which takes place, producer gas is generated.

The hot gas passes through a vaporizer, in which a small amount of steam is formed. This, with a limited amount of air, passes under the grate of the producer. In the smaller sizes the vaporizer is at the top of the producer where it uses the waste heat from the escaping gas, and where at the same time the water keeps the top from overheating. In the larger sizes the vaporizer is separate and connected to the producer by piping.

From the vaporizer the hot gas flows through the scrubber, which is merely a cylindrical-shaped tank filled with coke, over which clear water is constantly sprinkled. The large contact surface of the coke effectually cleanses the gas from dust and impurities carried over from the producer, and also acts to cool the gas, which is essential in order to prepare it for use in the engine. With certain fuels, especially where much tar is encountered, it is also necessary to add a sawdust purifier in order to remove the last traces of tar from the gas. While not absolutely essential, it is always advisable to use a

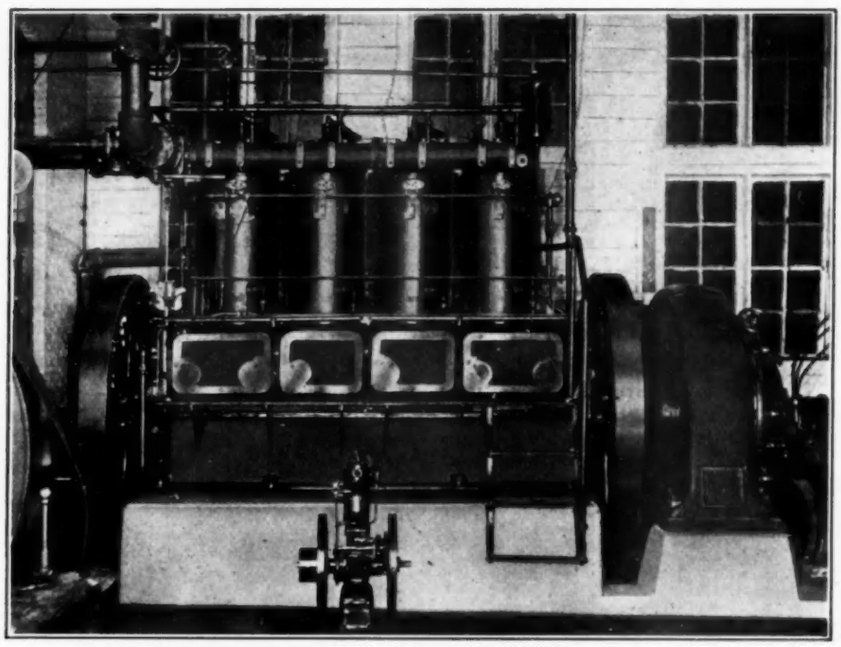


FIG. 3. A 2-HORSEPOWER AND A 200-HORSEPOWER FAIRBANKS-MORSE ENGINE

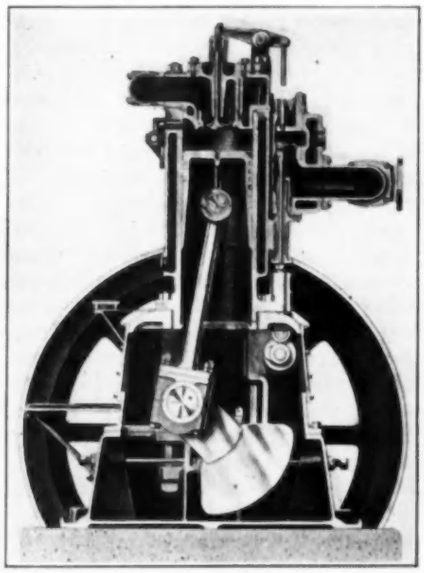


FIG. 4. SECTIONAL VIEW SHOWING PRINCIPAL WORKING PARTS

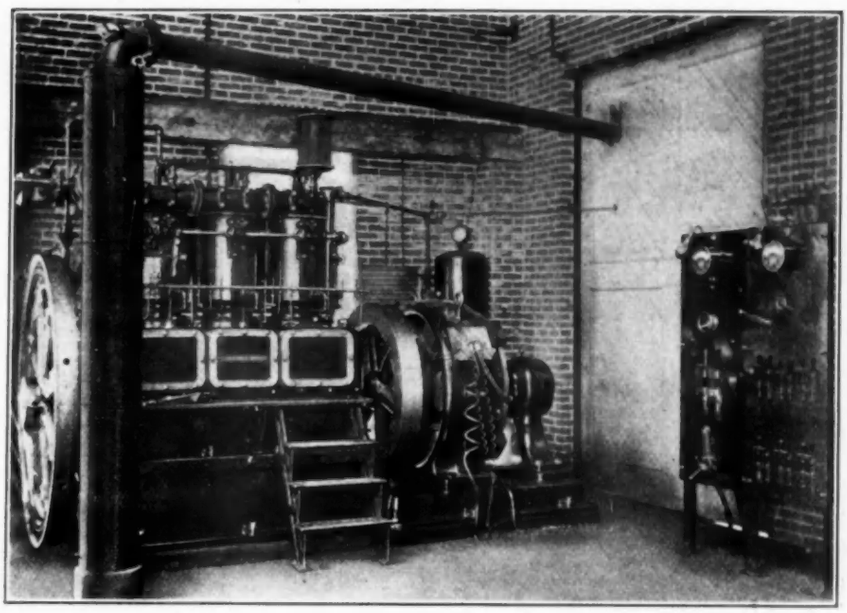


FIG. 5. 65-HORSEPOWER FAIRBANKS-MORSE PRODUCER GAS ENGINE DIRECT CONNECTED

gas tank between the scrubber and the engine, in which a certain amount of gas is stored. This is especially desirable where the loads are variable.

In the care of the producer the principal attention needed is to poke the fire every few hours, according to the quality of the coal, in order to break up and remove clinkers, which would otherwise interfere with the making of sufficient gas. Poke holes are provided so that every part of the fire can be conveniently reached.

Fuel

Anthracite in buckwheat or pea fineness, lignite, coke and charcoal are the fuels commonly used. In many sections these small sizes of anthracite can be bought very cheaply in carload lots; for example, in Chicago the carload price of buckwheat anthracite is usually about $3.75 per ton. In some of the States west of Chicago the price varies from $5 to $7 per ton, and in some points in southern Canada the small sizes of Pennsylvania anthracite can be bought for from $3 to $4 per ton. In some of the Eastern States, which are nearer the source of supply, the prices are even lower.

The lignite producer offers a wonderfully cheap and reliable power in sections where this fuel is available. There are enormous deposits of lignite in Texas, Arkansas, Louisiana, North Dakota, Montana, Wyoming, Colorado and other Western States. This can usually be had at a price of from $1 to $3 per ton. The lignite is of little value for steam-heating purposes, due to the large amount of moisture; but for a producer it is an excellent fuel and in some respects is easier to handle than anthracite coal.

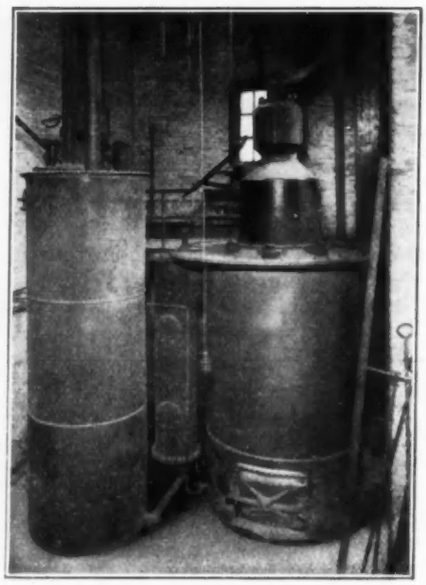


FIG. 6. 150-HORSEPOWER FAIRBANKS-MORSE SUCTION GAS PRODUCER

Coke and charcoal are economical fuels in some sections and can be used separately or mixed with anthracite coal.

With the best coal there is little formation of clinker that will not work down to the grate without poking from the top. Many European producers have no top poke holes. These, however, are not successful on American coals, for while it is always desirable to get the best coal it is practical to operate continuously on an average coal, or even a poor coal, by working the clinkers down by poking.

Anthracite coal may vary from 12,000 to 15,000 British thermal units per pound; coke from 9000 to 14,000 pounds; charcoal about 14,000; and lignite from 8500 to 11,500.

If charcoal is used as a fuel it is necessary to install a centrifugal tar extractor located between the scrubber and the sawdust purifier.

Lignite cannot be used in standard anthracite producers, but special lignite producers operate very successfully with this fuel. Gas from lignite averages 130 British thermal units per cubic foot. This fuel can be fed to a producer in any size that will go through the charging hopper, and it causes no serious trouble from clinkers.

Producer-gas Engines—Vertical Type

These engines are made by the Fairbanks-Morse Company in sizes of 200 horsepower and smaller. By combining several units, plants of 1000 horsepower or larger have been installed. Fig. 3 illustrates such an engine. A sectional

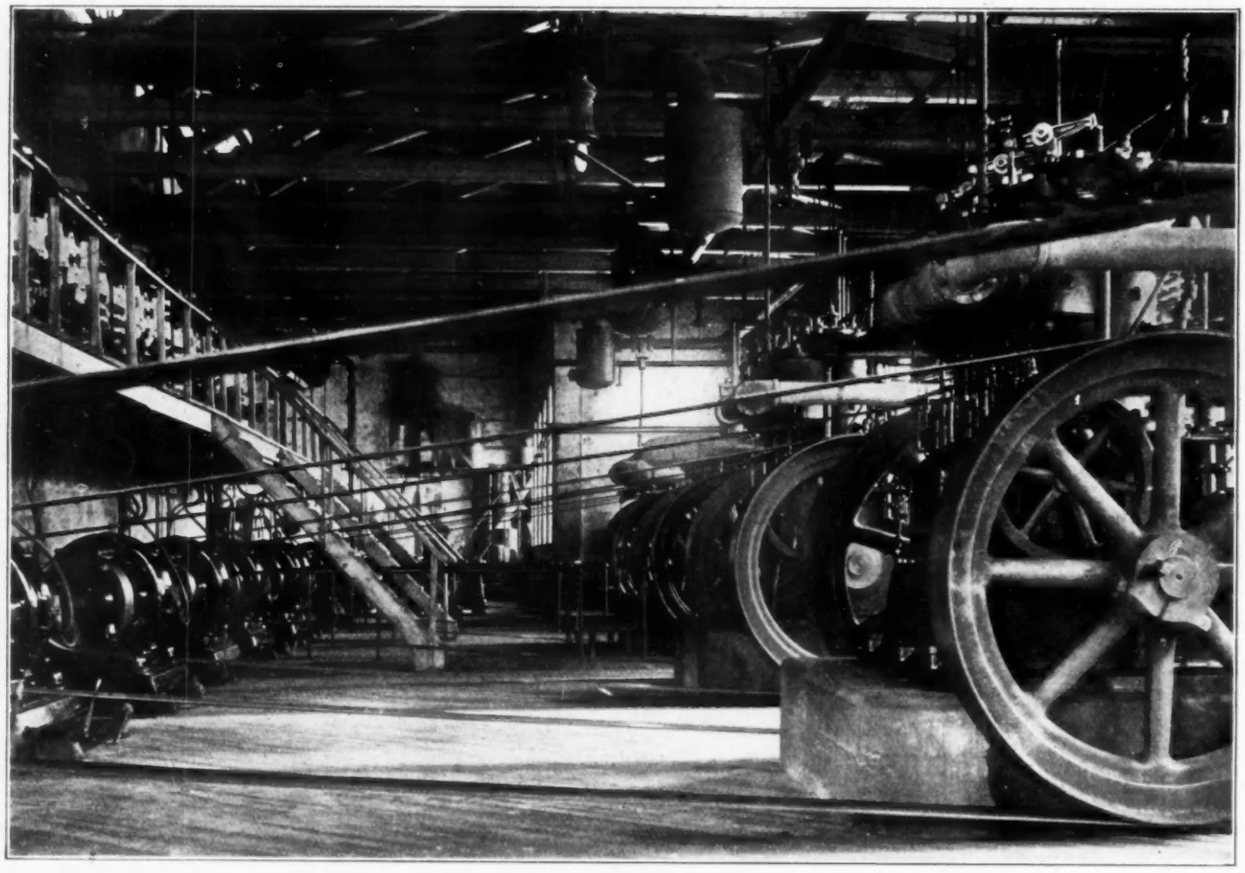


FIG. 7. 100-HORSEPOWER PRODUCER GAS POWER PLANT

view is shown by Fig. 4. A detailed description is unnecessary, but some of the special features may be pointed out with profit. The igniter is of the make-and-break type, and can be readily adjusted, either when the engine is running or at rest, by means of a hand lever. A single lever controls the time of ignition for all the cylinders. The igniters are so located that they can be removed, inspected, cleaned and replaced without interfering with any of the other working parts. Both valves are mechanically operated from a single cam shaft. The reduction gearing includes a pinion which is made of alternate layers of steel and red fiber to insure quiet running. The governor is of a simple flyball type. Lubrication is effected by means of a single elevated oil reservoir, connected with brass pipe through sight feeds to each bearing.

Each engine is fitted with a hand-operated speed regulator, by means of which the speed can be reduced when the engine is running. One cylinder of each engine is fitted with an automatic compressed-air starting gear. This can be thrown into or out of action by the movement of a single lever, and the engine is started automatically on compressed air.

Plants in Actual Service

Producer-gas-power plants have already come into general use for a wide variety of service, and a number of machine shops and factories have already installed and are using this form of power apparatus.

Fig. 5 shows a 65-horsepower installation in the shop of the Vacuum and Compressor Company, Wauseon, Ohio. This plant comprises a 65-horsepower engine and a 75-horsepower suction producer. The fuel used is Pennsylvania anthracite, pea size, and costs about $4.35 per ton at Wauseon. Electric current is generated for lighting and power. The power-plant operator, in addition to caring for the plant itself, attends to all of the electric motors, does steam piping and other work as needed. The average load is from one-half to two-thirds of the full rated capacity of the engine. At two-thirds load the fuel consumption is approximately 1 pound per brake-horsepower per hour.

The Mechanics Machine Company, of Rockford, Ill., is using a 50-horsepower Fairbanks-Morse type L horizontal producer-gas engine to operate its machine shop. The fuel is Pennsylvania anthracite, pea size, and costs about $5.30 per ton. The plant is operated by one of the regular machinists.

At Yalesville, Conn., the Jennings & Griffin Manufacturing Company is using a 100-horsepower Fairbanks-Morse producer-gas engine with semi-anthracite as fuel, at a cost of about $3.50 per ton. This plant has been in operation for the past two years. The engine often carries 110 horsepower for several hours, or an overload of 10 per cent. Actual records show an average of 990 pounds of coal for 24 hours with the engine in operation nine hours and standing idle 15 hours, and with a running load varying between 90 and 110 horsepower.

Fig. 6 shows the producer of the Vermont Marble Company, Chicago, Ill. This producer is a 150-horsepower Fairbanks-Morse and furnishes gas for two engines, one of 65 horsepower capacity and the other of 50 horsepower capacity.

Fig. 7 shows one of the largest suction gas-producer plants in the United States. It is the 1100-horsepower plant of the Fairbanks-Morse Manufacturing Company at Beloit, Wis. This plant comprises six 150-horsepower engines and one 200-horsepower engine. Anthracite coal is used as fuel. This plant is operated 20 to 24 hours per day, excepting Sundays and holidays.

This plant was previously driven by a Corliss noncondensing steam engine, taking steam from water-tube boilers using Illinois soft coal as fuel. While it is difficult to make an accurate comparison as regards fuel consumption, yet, as a matter of general interest, it may be stated that the steam plant required approximately three and two-thirds times as much coal per horsepower developed as the present gas-power plants.

Cement Chucks for Slender Work in the Lathe

By E. A. Dixie

So-called cement chucks are well known to watch- and instrumentmakers, but few

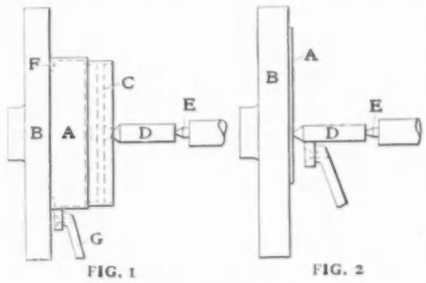


FIG. 1 FIG. 2

CEMENT CHUCKS

machinists know of them. Broadly speaking, they are face plates to which the work is secured by cement. Shellac makes a good cement; ordinary pitch is a fair cement, but in cold weather it is apt to be very brittle and a compound called marine glue is considerably better. Pitch and marine glue can be obtained from any ship chandler or dealer in marine stores.

The chuck or face plate should be of cast iron and perfectly clean and free from grease, as the pitch or marine glue will not stick to greasy iron. The chuck is heated and the pitch held against it while the face plate is turning slowly. The work should also be clean and free from grease, and heated slightly so that it will adhere to the cement. The job is then pressed, either by hand or by using the tail spindle, against the cement-coated chuck and allowed to stand until the chuck is cold. When the work has been faced on one side and it is desired to face the other side parallel with the finished side, some means of getting rid of the excess of cement is necessary. For work of this class I use a face plate in which radial V-grooves have been cut. These allow the excess of cement to squeeze out. Where it is necessary to center the work a roller is very handy. If the work has been turned on the perimeter, or is approximately round the roller can be used as in Fig. 1, in which *A* is the work and *B* the cast-iron face plate to which the cement has been applied. *C* is any finished casting, such as a change gear; it is used between the bar *D* and the center *E* so as to press the work in line with its point of contact *F* with the face plate. When using the roller for centering the face plate and the work are hot and the cement plastic. The work *A* is placed approximately central and held in place while the casting *C*, centering bar *D* and center *E* are adjusted. *Slight* pressure is applied by the center *E* and the roller *G* in the tool post is brought as near the face plate as convenient. It is then fed toward the center while the face plate turns slowly. The action of the roller is to center the piece, gradually pushing it into central position. Fig. 2 shows another use of the roller. In this case the work is a thin plate, which is, we will suppose, square or irregular, and has some lathe work, the center of which is at the point occupied by the center of the bar *D*. This bar is ground true all over after hardening, and has male and female centers.

The work is set up as before, but without the casting *C*. The bar *D* is centered at the center of rotation of the required lathe work and the tail center *E* is tightened up enough to hold the job against the face plate. The roller is now brought against the bar *D*. It is immaterial whether the bar *D* rotates with the work, for if the work be eccentric the bar will move with it, and coming in contact with the roller as it gyrates it and the work will be centered.

Lense makers use cement chucks to a great extent. The glass blank is centered while the cement is still plastic. Ordinary steel hand tools are used for turning the glass lubricated with turpentine; some lensemakers use turpentine and spirits of camphor mixed.

A despatch to the *London Times* from Berlin says that a promising substitute for coal gas, especially in the case of plants supplying small towns, is the Dannert gas, which has been brought out quite recently in Germany. This gas is made from oil and coke, and burns with a bright flame in an ordinary burner.

Practical Letters from Our Readers

A Round Table Discussing Details of Modern Machine-shop and Drawing-office Methods, Practice and Economy

WE PAY FOR USEFUL IDEAS

A Story of One Boy's Success Recently Read to a Class of Boys at the Artisan School

This is a true story of how one poor boy made a man of himself, because he listened to and acted on the advice of an older man of experience. The man who gave the advice was C. P. Huntington, president of the Southern Pacific railroad, who was himself a self-made man. As I have before told you Mr. Huntington told me this story about ten years ago, so I know it is true. One day he was at his desk in his office in the Mills building on Broad street, New York. His porter showed in a good sized boy about seventeen years of age, who asked Mr. Huntington if he could not give him a job in his office. Mr. Huntington told him every place in his office was filled and there was no chance for him. The boy looked much disappointed and started out, but at the door he hesitated, turned back and asked Mr. Huntington if he would not give him fifty cents to buy his breakfast. He had had but little supper the night before, had spent his last twenty cents for a night's lodging, and as it was now nearly noon he was very hungry and hadn't a cent to buy breakfast. Mr. Huntington asked him if he was not from the country, his clothes and manner indicating he was not a city boy. The boy said he was. Mr. Huntington asked him if he did not have some friends or relatives, or someone he could live with until he could find work. The boy said there was not a single individual in the city he knew. Then Mr. Huntington said to him:

"You are a lucky boy. You are now thrown on your own resources, and must work out your own career without outside help. This will test the stuff you are made of. If you're made of good stuff you will come out all right, but if you are made of poor stuff, you will stay at or near the bottom of the hill all your lifetime. I won't *give* you fifty cents to buy your breakfast. Fifty cents is far too much for you to spend for a breakfast. I will tell you how to *earn* money to buy your breakfast."

Mr. Huntington's custom was to walk from his house in Fifth avenue to his office every morning, about three miles. He did this for outdoor exercise, not to save money, for he was worth his millions. He resumed:

"As I was passing the Tombs prison on Centre street this morning I saw a gang of men taking up the stone pavement and piling the stones on the edge of the sidewalk. You go up there and tell the boss you want to pile stones enough to earn six cents to buy your breakfast. The boss will see you are in earnest, and will give you the job, even if he has to pay the six cents out of his own pocket. When you have earned the money and got it in your pocket, you go to a bakery and buy three cents worth of bread. Tell the baker to give you yesterday's bread and he will give you double as much as he would of fresh bread. This, with some water, will give you all the breakfast you can eat, and put you in good shape until supper time. You are now a capitalist, you owe no debts and have got three cents, money you have earned by honest hard work, in your pocket. Now you walk up town and watch out for a cart loaded with coal. When you see one make sure it is going to a house, and not to a coalyard. Follow that cart and go into the house where it is delivered and ask the woman for the job of carrying it in and stowing it away. She will see you are in dead earnest and will give you the job."

The boy listened to all that was said and left the office. About three years after that, Mr. Huntington was walking down to his office, and just as he was passing the postoffice on Park Row, a young man came up to him and said, "Good morning Mr. Huntington." Mr. Huntington looked at him and said, "Good morning, but I don't know you." The man replied: "Don't you remember about three years ago you advised a boy to go to Centre street, earn six cents piling stones; to buy three cents worth of bread for his breakfast; then go up town, follow a coal cart and get the job of stowing it away?" "Yes, I do remember it." The man resumed, "I am that boy, I did just as you told me to do, earned the six cents, went up town, found the coal cart, got the job of stowing, went to a corner grocery, borrowed a soap box, carried that coal up three flights of stairs and got seventy-five cents for doing it. I returned the box to the grocer and asked him if he could not give me a job. He asked about the coal-storing job, said as I had returned the box as agreed, he thought I was the sort of boy he wanted. I went to work for him, and now I own half interest in that store, and before the end of another year I will own the whole of it. My boss wants to move into a bigger store and he will sell me the old store on easy terms."

Mr. Huntington was naturally much pleased, and said he had always noticed that all those boys made of the right kind of stuff got on and made of themselves independent, self-reliant men and good citizens.

I would ask Mr. Sweet how many boys in his school are made of the kind of stuff this boy was made of. How many of them will turn out honest, self-supporting, reliable self-made men. I fear not a few of them will get weary, and conclude they will hunt for softer jobs. Watch these boys and you will find out that four out of five of them will stay at or near the bottom of the hill and take up jobs no one else wants.

Dublin, N. H. STEPHEN W. BALDWIN.

The Inventor Died

The note in the AMERICAN MACHINIST concerning the failure of the so-called "suggestion box" reminds me: I called at a sewing-machine factory to see if I could get some gears to cut and it came out in conversation that the concern had been running for 10 years, but was a failure the first eight. "Why is that?" I inquired, "Oh, the inventor died about two years ago and we have been making money since then," was the reply.

It is a good average plan not to invent anything, or encourage others to do so, but to depend on outside lunatics for improvements. When you generate an invention and have got it complete on paper and ready for the United States Patent Office examiner to sit down on good and hard, say: "Now, this thing is ripe for the waste-paper basket. I have gotten all the fun out of it and there is nothing left but expense, labor, law suits, and quarrels with other inventors. Chuck it!"

Invention, the useful sort, is by no means as spontaneous as the "no patent, no pay" breed of patent agents would have us believe. It is distinctly professional, requires long study and a peculiar adaptation as well as opportunity and a bottomless bank account. There are ten or twenty thousand patents on car couplers, each and every one of which is absolutely worthless, but, nevertheless, a gem in the opinion of its brakeman inventor. Every cross-eyed brat has a mother. Throw an abundance of cold water on every invention that shows its head in your place

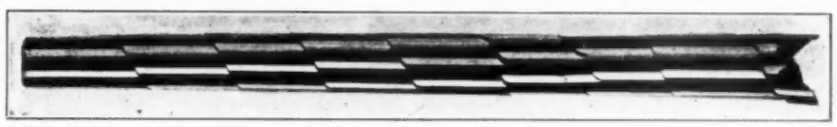
and you will be the gainer nine times out of ten, and the tenth time you will not lose very much.

Boston, Mass. GEORGE B. GRANT.

A Peculiar Hardening Freak

The readers of the AMERICAN MACHINIST who are interested in the hardening of small tools will find something to think about in explaining the cause of the freak reamer shown herewith.

This reamer was about 8 inches long in the flutes and had a taper of ⅜ inch to the foot. It was used for finishing a hole in a bronze casting, the job having been previously roughed out by a stepped reamer. A cracking noise warned the operator that something was wrong, and on withdrawing it from the work it came out in one piece, but with the peculiar spiral steps shown. Unfortunately it broke near the center (the greater part being shown in the cut).



THE CRACKED REAMER

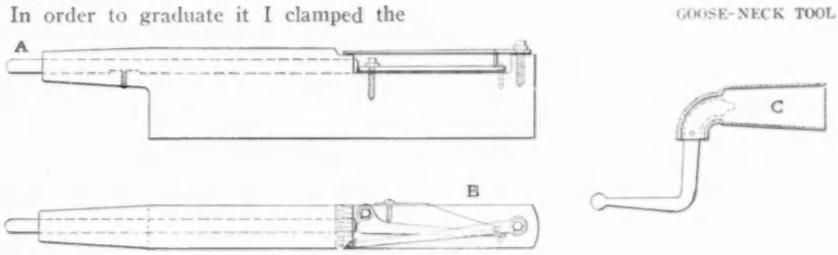
The reamer had finished several castings before the break occurred, and its present state should clearly show the uniformity of its hardening.

Chicago, Ill. L. P. SITTIG.

A Test Indicator

The accompanying sketch shows a test indicator for truing internal and external surfaces in a lathe, or it may be used in a milling-machine vise for testing arbors, etc.

In order to graduate it I clamped the body on a bench plate, then fastened a micrometer depth gage so it touched the rod *A*, and each thousandth I moved the gage, marked where the indicator pointed, and found it made a neat and fairly accurate job.



A TEST INDICATOR

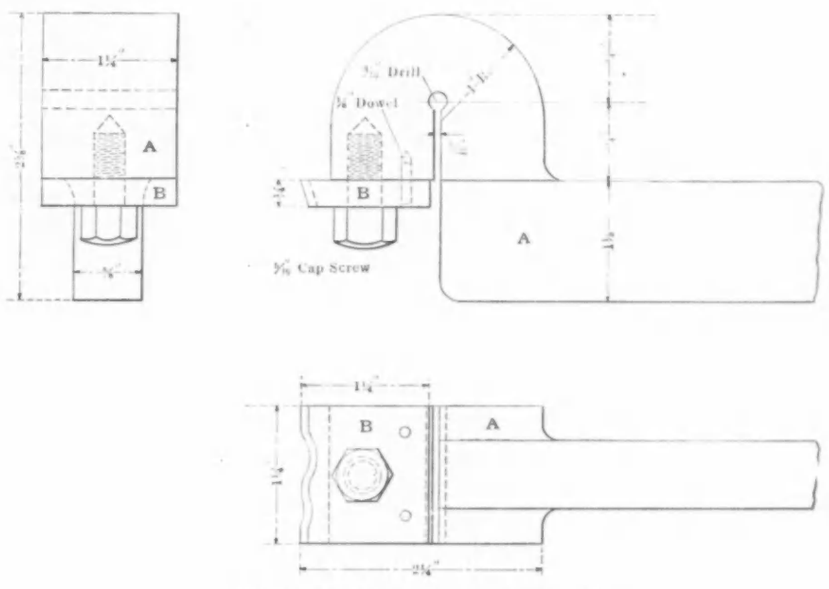
The spring *B* should be made of thin stock, say about 0.012 inch thick by 3/64 inch wide as the lighter the spring the more sensitive the instrument will be.

An attachment is shown at *C* for internal work, which can be used in a hole as small as 3/16 inch.

Jamaica, N. Y. H. M. MACK.

Goose-neck Tool for Forming Cutters

The sketch shows a style of "goose-neck" tool, which is very useful in making formed cutters of irregular outline. The stock *A* may be made of 1¼x2⅝-inch tool steel machined to the dimensions given. The cutting blade *B* is shown as made of ¼-inch tool steel, but can be made heavier if necessary. The seat for the blade may be corrugated to further prevent slipping. By putting the blade on the under side of the groove neck any tendency to crowd into the work is eliminated and a smooth surface is produced.



GOOSE-NECK TOOL FOR FORMING CUTTERS

This tool produces far more satisfactory work than the ordinary solid forming tool, and by making cutters of various outlines its range is universal within the class to which it belongs. In using it care must be taken to have the top plane of the cutter set normal to the surface of the work in order that chattering may be avoided. The sketch is self-explanatory as regards sizes, which may be varied, proportionally to adapt the tool to different classes of work.

Boston, Mass. C. O. DOAN.

Brazing Castings

Having read in the AMERICAN MACHINIST some time ago, of a Pittsburg concern that was mending all sorts and kinds of castings, it aroused my curiosity to some extent to see how the thing was done, but I had no idea that I would be doing the same work at some future time. Such, however, the fortune of a handy man, that knows how to do certain things and has to be quick to grasp an idea.

I was under the impression that it required considerable preparation in the way of blow pipes and other paraphernalia to do this work in the way it should be done, but I find a common forge with charcoal fuel does it as well as could be desired for general repairs on castings that are not too large. While we have so far confined ourselves to castings of from 6 to 25 pounds we have not had a single failure and the joints are apparently as solid as the original piece.

We use the Castolot preparations, which are a Swiss production that does the work in a very simple manner. There are two preparations used in the process, with raw borax as a flux, and the *modus operandi* is as follows:

After cleaning the broken pieces thoroughly with a file brush preparation No. 1 is smeared on the edges of the casting so as to completely cover them; the casting is then clamped together and laid on the clean charcoal fire until the casting is hot enough to melt this dope. It is then taken apart and the edges of the joint covered again with preparation No. 1, after which the casting is clamped together and placed on the fire and the

heat very slowly raised to a bright red, with plenty of fuel under the piece. The borax is now applied and allowed to melt so as to combine with preparation No. 1, meantime raising the heat by a little more blast. When a bright red, preparation No. 2 is applied evenly on the crack from one side to the other and the blast turned on to melt it quickly. Just as soon as this occurs and it is seen that the spelter is in a liquid state and covers the surface of the crack from side to side, the blast is shut off and the piece allowed to cool down until black. After this it is removed from the fire and cooled thoroughly before removing the clamp.

The clamping is one of the important features and it must be understood that the clamps as well as the casting will sometimes get red hot. To hold the pieces together perfectly and prevent their getting out of shape, the clamps must or should, hold it tight from both sides and draw together tight as possible. If rods be used, those on the top side should be heated so as to equalize the expansion, otherwise those next the fire will expand so much as to distort the casting, which should be kept in its original position after the spelter (preparation No. 2) is applied.

The whole secret of the process is to have the spelter distribute itself evenly over the surface. This is a hard matter to do where the surface is uneven and the crack is across both thin and thick surfaces. The heat does not distribute itself well in this class of castings, but I overcome this by building sides on the fire and laying a heavy board across the top to keep the heat in. The spelter I put on the highest points and let it flow down to the lowest and if contrary about doing so, I help it along with a brass rod flattened for the purpose.

The casting should lie in the fire perfectly level and the fire should be built so it will not burn out beneath the casting and allow it to drop down. This would spoil the joint and the work would have to be gone over again.

It requires very little skill to do the work except in the heating. A very little overheating will melt the casting, as well as the spelter, especially if made of coarse-grained iron.

For this work, a furnace would give better results than an open forge and where many castings are breaking and being repaired, the expense of preparing for the work properly would soon pay for its installation.

We have castings now awaiting repairs that weigh from 200 to 1000 pounds and as the smaller jobs have been a success, these larger ones will be taken up as we are satisfied they can be well done if the means are provided for heating them and enough dope is forthcoming at $5 per pound to fill the joints.

St. Louis, Mo. T. Toot.

Tapping Nuts in the Lathe

Recently I had occasion to tap a lot of bronze nuts, Fig. 2, with a 2-inch diameter 1-inch lead quadruple thread.

We had always done this job in a lathe, chasing the thread and finishing it with a tap. This method was very slow and a mean job, as the pitch was so steep. I then made a tap with inserted teeth, Fig. 1 of a piece of shafting 1⅜ inches diameter, 32 inches long. I machined six slots in it ½ inch wide, 1½ inches long, and 2¼ inches apart. Into these slots I fitted the tool-steel cutters *A*, which were held in place by taper pins. The cutters were so spaced that one would be started before the other was through the nut. The nuts were held in a fixture (secured to the cross-slide of the lathe), bored after it was in place on machine. The tap was driven by a hood made to fit the spindle of a Reed lathe. The lathe was then geared to the proper lead and the nut tapped. After the nut was tapped the tailstock was pulled back and the tap taken out.

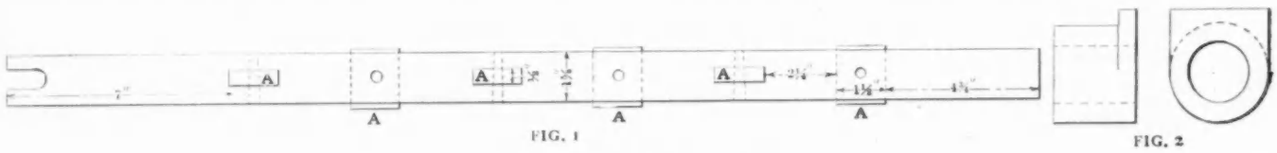


FIG. 1 FIG. 2

TAPPING NUTS ON THE LATHE

Cleveland, Ohio. Foreman.

Grinding Problems

Will it ever be possible, when we have a grinding job to do, to sit down, take up a catalog of emery wheels pick out a wheel of a given diameter, face, grade and grain, order wheels and get something that will do the work within a reasonable limit of time corresponding to performances such as we see recorded in catalogs and advertisements of makers of grinding machines and emery wheels? Present indications seem to be against these prospects.

I had a large grinding job to do. Considering past experience, I concluded that a wheel of a standard make, of a given grade and grain, would be about the proper thing. I was guided by advice, published by well known makers of emery wheels, in my selection. To make doubly sure, I sent to this firm a drawing of the piece to be ground with full information as to kind of finish, make of machine wheel was to be used on, etc. In answer, I was told that I was totally wrong and was advised to use a wheel of an entirely different grade and grain. I ordered two of these wheels as recommended, tried them at the speeds of wheel and work as advised, which trial resulted in an utter failure as far as time and standing up qualities of the wheels were concerned.

Then I ordered the wheel which I originally selected and got far better, although not perfect results. In looking over some performances of grinding as advertised by makers of a well-known make of machine, I tried to duplicate these performances, following as closely as possible the conditions governing the work and trying to come somewhere near the time they claimed to have made, with the result that my best grinder hand left, disgusted with my slave-driving methods, as he explained it. I got another grinder hand who came highly recommended. After giving him a few days to size up the machines, I had a talk with him and he stated that I was not using the right wheels; I should order Smith's wheels, he had always done good and quick work with them. So far so good; I ordered some of Smith's wheels after his selection and got impossible results. He then stated that he had used Brown's machine instead of ours which is Jones' and that probably, that made all the difference. I could hardly sell our new Jones machine and get Brown's to accommodate these Smith wheels, so we plod along, doing our best.

Now, may I ask, is there a key to this combination? If I have Jones' machine, must I order Brown's wheels or Smith's or White's or Jones' or Black's or anybody else's? Or if I have Brown's machine, must I order any of these in preference to others? And so on through the whole combination. Every traveling salesman recommends his make and for reason; and the result is a nice, neat little sum of money tied up on a heterogeneous lot of emery wheels, good, bad, indifferent and some perfectly useless.

Makers of grinding machines claim in their catalogs and advertisements that on a certain diameter shaft of a given grade of steel, their machines will remove a certain amount of stock in a certain time. I have spoken to a good many operators, foremen and superintendents on the subject; nobody has yet actually given me proof that they came anywhere near duplicating these performances. I have personally never obtained these results.

Occasionally somebody ventures an article on the subject of grinding. Absolute data, however, are always missing and most authors conclude with the statement, that after all, the whole thing is a matter of judgment; or I should say, guess work.

Albany, N. Y. L. F. C. George.

Discussion of the Previous Question

Letters from Our Readers Showing How Many Men of Many Minds Look upon Various Subjects Opened up in Previous Numbers

WE PAY FOR THESE ALSO

The Suggestion System

[In an article on page 643 Mr. Porter stated some of the reasons why many suggestion systems fail, and a brief outline was given of his methods that have achieved success. In an interesting article in the *Transactions* of the American Foundrymen's Association, the secretary, Doctor Moldenke, presented his observations of a factory organization using Mr. Porter's methods. The following paragraphs are taken from that article and a letter, from Mr. Porter to Doctor Moldenke in further explanation, is also republished.—ED.]

Some time ago it was the fortune of the writer, while on professional business, to observe the working of a very interesting method of "getting together." The shop was fairly large and not far from a great city in the eastern part of the country. Being the first instance observed by the writer in which men in the shop were represented in committee, an outline of the shop policy will be of interest. First of all a chart of the organization was posted through the shop from which everyone could understand his proper place in the line of responsibility. The "works committee," composed of one representative elected from each department of the works, acted as the lower house. Elections were arranged so that one man dropped out each month, a new one being chosen. Thus the personnel of the committee changed about once each year, giving many men in the shop a chance to act and become familiar with the work. The committee met once a week at lunch, the latter being furnished by the company.

The "advisory board," composed of the superintendent as chairman, and the foremen and heads of departments, acted as the upper house. This committee met daily, informally, at lunch, the coffee only being furnished by the company.

Signed suggestions, collected from the suggestion boxes and copied with the signature taken off, were first discussed by the lower house and then referred to the advisory board with recommendation for adoption or rejection. Finally, after action by this board, they went to the manager with the action of both houses marked on them. Once a month, in the evening, the two houses met for discussion of the general shop policy, the adjustment of special cases, etc., the manager presiding.

The works committee, a real grievance committee, were required to take up the case of every man who considered himself wronged, before it reached the general board, and the result was the righting of every intentional or unintentional unfairness within that shop. Disloyalty was thus overcome in a great measure, or at least quickly stamped out by the removal of the offender. The management had installed many "betterments," however, without frills. Stages to transport those living in the great city nearby were furnished at cost to the men. Lunch was also provided at cost, and opportunity given to each man to let him feel that he could remain clean and decent if he wished to.

Every new-comer was taken in hand by this shop committee first and the situation explained to him. He was told that he would not be accountable for entering a saloon, or more of them, but he would be so held for the condition he was in when he came out. He was further told that if he had any complaint or suggestion to make, there was a box in his department provided for that purpose. His complaint, if just, would be righted. His suggestion, if accepted, paid for. Every suggestion, by the way, had to be signed, though treated as before explained. Anonymous communications were not considered.

For each suggestion accepted $1 was paid. Quarterly $5 was paid to the one who had the greatest number of suggestions accepted. Three dollars to the next and two to the third. Fifteen dollars was paid the foreman quarterly from whose department the greatest number of adopted suggestions came, and $10 to the next foreman.

It will be seen that such a method, the barest outline of which only is given here, takes into consideration the "justice to everybody" question which should really be the foundation of our system of employment. The system above outlined, by the way, has been devised and introduced in a number of establishments by our friend, Mr. H. F. J. Porter, who will doubtless be glad to give further information to those specially interested.

Now a few comments by the writer, who attended as well as took part in one of these general meetings above described. The earnestness of the men was remarkable. They came promptly and stayed late into the night voluntarily for the good of the cause, and while the discussions were at times fierce, the chairman kept things well in hand and business was despatched quickly and effectively. The fact that the voting was invariably unanimous when through with the discussion showed well for the system. Now the apparent drawbacks as observed by the writer, a stranger to this system: All systems, no matter how well devised, have to do with the human element. Some of the men present at this meeting were carried away by their devotion to the ideals aimed at and, therefore, expected too much. The millenium is still far away, and they—notably the works committee—found it hard to realize this. Others had their petty jealousies which were bound to crop out. The tendency to put the blame on the other man when it showed itself was quickly discounted by the rest of the assemblage, as a scrutiny of the faces revealed. Again a noticeable drift was occasionally manifest of several people getting together before the meeting to play politics, as it were. Now such things are always bound to crop up where man meets with his kind. A good judge of men, as the chairman must of necessity be, will always see that no lasting harm is done, or else he will apply the weeding process. Every man who is placed so that "the conscience which recognizes obligation" (so ably put by our member Mr. Alexander), is held right against him, will either make good, or soon be a candidate for another place. By the way, it may be remarked that the manufacturing concern in question from being a nuisance to its community before this system of "get together" was applied, became a factor for good thereafter. The organization was increased 100 per cent. in six months, and sales and profits went up proportionally. It was simply a good example of shop organization on advanced lines. It will pay our foundrymen to do a little thinking along these lines to see if some of the above may not fit their case.

DR. RICHARD MOLDENKE,
Secretary American Foundrymen's Association,
Watchung, N. J.

My Dear Sir:

I am just in receipt of the proof sheets of that part of your transactions covering your editorial remarks on "Shop Organization," in which you describe the working of a system of management introduced by me in a shop which was very much run down and which I had been asked to reorganize. I presume from the tenor of your remarks that you were present only at one of the meetings of "the council" composed of the members of both the works committee and the

advisory board, which was held once a month to discuss matters of interest common to both employer and employee and questions of general policy of management.

It is difficult for a perfect stranger to the system to fully realize the function of this latter gathering, or to understand its true value. It was in fact a clearing house for complaints. It offered the opportunity for all hands to bring up any matters which were causing trouble. It was the monthly "wash-day," and everybody was asked to bring here anything which he felt was a source of ill-feeling, or every case of alleged unfair treatment, so that all such matters could be thoroughly investigated and cleaned up and the feeling perpetuated throughout the organization that both sides were giving and receiving a square deal.

You say that you noticed that the votes were always unanimous; that was because care was always taken to have every question thoroughly discussed until everyone was satisfied that the action proposed was the best that could be devised.

In this way every month there was an outlet offered for pent-up feelings, but there was at the same time being gradually developed a better understanding for both sides, of the others' point of view, and each became convinced that the other in his own way was making the effort to work for the common interest of both.

One of the best evidences of a change for the better in the character of the working force was the growth of permanency in its personnel.

Before the effort at reorganization was begun the works had the reputation of being a "mean shop," and it was with difficulty that good men could be secured to work there. The organization consisted of floaters. There had been a change of 20 per cent. per month, 240 per cent. per year in the working force for a long time. This loss was gradually lowered to 15 per cent., then to 12 per cent., then to 10 per cent. and 8 per cent., while the organization doubled in numbers. The stringent rule against drinking had much to do with this improvement, and this rule was proposed and enforced by the men themselves, who took an ever-increasing pride in their organization.

It was the better class of workmen, together with the improved conditions and methods introduced, which made the place pay. I am very glad you had an opportunity to see the system at work and to know that it impressed you favorably even to the cleaning-up process. It is the best cure for so-called labor troubles I know of.

Very truly yours,
H. F. J. PORTER.

Your recent editorial on the above subject compels me to offer some remarks. I do not believe in the suggestion box as a receptacle hung on the wall, once in a while opened and the contents given a superficial or biased examination which would be the result in nine places out of ten.

Our people have the suggestion box in actual as well as successful operation; our method is on the following lines: All employees have the right to orally express and explain their suggestions to either the superintendent or master mechanic. If their suggestion has merit, they are given an expression of it; if it is considered of no merit the employee has the objections explained to him thoroughly. The chances are that the employee overlooked several points to be taken into consideration. After these are called to his attention and he sees the non-feasibility of the suggestion, he does not feel aggrieved, but better for the courteous treatment received.

If the suggestion is good, compliment the man, boy or whoever the suggester may be and, if the merit is great enough, reward the man by a suitable raise in wages. By all means do not rob him of the glory by going to the management and showing "what I have done." The greatest cause for the failure of the suggestion box is the narrow-gage men who hold positions above the regular workmen. Give the workman a square deal and he will give you results as well as respect you.

Grand Rapids, Mich. F. C. MASON.

I have had pleasure in reading your comment entitled "The Other Side of the Suggestion Box," on page 392, also F. H. Neeley's article, on page 570. The purpose of this letter is to add a thought that may give some of the reasons for the failure of the suggestion-box system to fill the long-felt want of justice, coöperation and profit for all concerned.

Every conscientious and ambitious employee endeavors to make his brain save his hands, and sooner or later in life he discovers the fact that his ideas are of some value. His first thought is to make them pay him a revenue through meritorious recognition by his employer, or by taking out a patent. His second thought reveals the fact that a patent in the United States is only a chip on his shoulder by which he says to the public, "I have invented something and you must not use it without my consent; if you do I will fight." Should he be unfortunate enough to start the fight, his chances are about eight to one in favor of someone else having his money and good ideas, while he cashes experience for his.

That some employers have taken an unfair advantage of their employees in cases of this kind, thereby discouraging them and causing no end of dissatisfaction, is altogether too true. Thus it is not to be wondered at, that the good intentions of appreciative employers are so often received with little show of interest and much distrust by the average workman. The employer too often underestimates the intelligence of his men, forgetting that the workman is closer to details than it would be consistent for the proprietor of a large business to be, and, therefore, if encouraged, would give his employer ideas of inestimable value. It is also true that the inventor often overestimates the value of his services and ideas, because of his lack of knowledge of costs other than labor and material; but this fact should not relieve the employer of his responsibility in neglecting to put forth every effort consistent with good business sense, to show such a person the truth of the problem. There is hardly a man that has worked at the machinist trade 10 years that cannot recall at least one incident where his suggestion was taken to the management as an idea of his foreman or superintendent, thereby giving credit to whom it did not belong.

The objects of the suggestion box are justice, coöperation and profit. The first requisite of such a system should be a man at the head of the department that would merit the confidence of both employer and employees; one that could readily detect evil motives in the suggestion or complaints, and put a stop to them. Second, give to each communication a thorough investigation, and, if rejected, give evidence to the suggester of the impracticability of the considered project that will convince him beyond any doubt of the company's square policy. Third, if the suggestion is accepted and the employer installs it, the suggester should receive a compensation in proportion to its value; the value being based upon a percentage of the net saving to the company for a stated period of time dating from its actual application.

A system of this general type has been in use at the Accrington works of the Ewbank company, in England, for some time, and according to R. W. Kenyon (a director of the company) was very successful. By the Ewbank method, one-half of the profits due to the installation of an accepted suggestion is given to the suggester for a period of two years, which looks very good to an ambitious employee, but payments will cease if he leaves the company's employ before the expiration of the two years. In my judgment, this proviso eclipses the good features of the system. If the suggestion saved the company $5000 in two years, and the man left the company's employ the next day after its adoption the suggester is justly entitled to $2500. The Ewbank provision would give a hard-fisted or unjust employer an opportunity to find unreasonable fault with such a man, and make it so unpleasant for him that he would have to go.

I know of a case where an employee offered suggestions that earned him about $125 extra in a little less than three months. He was told that he paid more attention to other business than he did his own, and several other reasons of like

character were given for his discharge, which took place without reasonable notice being given.

The most disgusting and unjust feature of the suggestion box practiced in this country that I ever witnessed happened not long since, where with great pomp and ceremony one employee was given a $100 prize for offering the best suggestion the previous year. The company publicly admitted that the invention saved them $50 per day, or about $15,000 per year. The second prize was $50 for a contrivance that was not worth, as a saving factor, to exceed $3 per day. If the price, $1 plus $50, was a fair price for the saving of $3 per day, why should not the first prize have been at least $850? If the company had paid 25 per cent. of the net saving for two years to the suggesters, it would have been the best kind of an investment in cold cash, to say nothing of opening the way for coöperation and profit that would be just and equitable.

The fact that the possibilities of improvement are limited only by the natural limits of the help employed makes the Ewbank method the best system in use to date. It seems to me there is good reason to believe that the Ewbank system with the good features mentioned by Mr. Neely and suggestions herewith, will be successful anywhere, provided the square-deal policy is kept uppermost in the minds of all concerned; for "where there is justice there is no room for charity." One well known writer has said "The man that never does any more than he gets paid for, never gets paid for any more than he does." These ideas work both ways. A good man never receives charity, and an employer that never pays quite as much as an employee is worth, seldom receives a service quite as valuable as he pays for.

Cleveland, Ohio. CYRUS F. RAYMOND.

Accurate Planing to Avoid Unnecessary Scraping

The article on page 367 on the above subject was very opportune. Accuracy on the planer is a subject not only of great interest generally, but also of great importance to manufacturers of planers.

First of all, what are the results obtained when we handle a planer job as carefully as we can, even without taking into account the time spent in setting up and planing? Results will differ, first according to the castings.

We will at present only consider the planing of cast iron. Take a casting of rigid construction and section, for instance, a lathe bed of improved design. Now if we have two castings of a slightly different grade of iron or two castings which have been cast at different times, or again two castings, one of which has been exposed outside in the yard to all kinds of weather, say, for six months and the other fresh from the foundry, a couple of days old, and we set up these castings and plane them exactly in the same manner, we will obtain different results.

With hardly any exception a casting will show hollow or low in the center after it comes off the planer, no matter how carefully it has been set up. I have seen lathe beds planed, 14 and 16 feet long, which, when set up, were pulled down at both ends 1/32 inch and when finished planed, came out reasonably straight, whereas they would come out about 1/32 inch hollow or low in the center when set up and planed in their natural position. This was found necessary on fresh castings. How long they stayed straight after scraping in, I cannot tell.

A casting which must be finished all over, or say on top and bottom, requires at least three cuts on each side to produce satisfactory results. A roughing cut after the first setting up, turned over and a roughing cut on the opposite side. Resetting and a second cut on top, turned over again and a second cut on bottom. Second resetting for final finish on bottom, turned over and final finish on top.

As the setting up of a piece of work on the planer generally requires more time than the planing itself, it is no wonder that planer work becomes expensive if accurate work is required.

Too much care cannot be taken in the first setting up and bolting down of the work for the first cut when the scale is removed. It is my practice to see that the planer hands do not put more strain on bolts and clamp than is absolutely necessary to hold the work and if the work is properly stopped off for end and side thrust, no very heavy clamping is necessary. The shimming up should be done very carefully and more good judgment is required in setting up a piece of work on the planer, than on any other machine. I dare say, that even today, with the massive looking machines built, there is not a planer made, the bed of which cannot be sprung by injudicious setting up and clamping and under these conditions, good, accurate work is impossible.

I must acknowledge that it is a very bad appearing showing to make in the shop, to have a piece put on the planer and have the machine stopped for several hours while setting up. I find, however, invariably that it pays in the end to be careful and not to rush this most important part of the work.

Take any planer, no matter of what make or size, rough plane a casting ready for the finishing cut. Now set and clamp the finishing tool, see that every movement is free without binding, yet without any play on the cross-rail or in the head. Make sure that the clapper works freely and snugly in the clapper box and that the taper pin in these is just right. Be sure that the cross-rail is securely bolted to the housings, in fact take every possible precaution to insure good results.

Start a finishing cut of about 0.003 inch deep, feeding across the table by hand, say ½ turn of feed screw. I say by hand, because experience has taught me, that on a finishing cut, the friction and feed mechanism, including rack, gears, ratchet, etc., affect the cut through its jarring motion. After a few strokes of the machine and on the return stroke, lift up the tool from the work until the clapper stands at about 45 degrees. Now release your hold and let the clapper and tool fall back by its own weight in the clapper box, just before the next cut begins. If there is any planer made which will continue the cut just as started without any change and not cut deeper, I would like to see it.

This test proves conclusively that there is something loose, which can move between the cutting point of the tool and the place where the housings are attached to the bed, but where? I say everywhere and there always will be as long as the present mode of construction and design is followed. With a good many others, I am willing to confess that I cannot suggest anything better.

I firmly believe, however, that some day, somebody will solve this problem. In the meantime it would not be bad policy for any shop to try to turn out some apprentices and workmen who are first class.

The idea of having a separate planer for finishing work only is an excellent feature, which, however, would not be countenanced or pay in every shop. I also find that the best method to follow, is to rough out the castings, that is, take off all the scale where finish is required, then lay them outside, exposed to the weather for a couple of weeks, rough finish them and reset them to finish cut.

Some time ago I made three surface plates, 16x18 inches. Following this method, the total time of planing on the three was 11 hours, the scraping in together require 18 hours and the results were very satisfactory, the plates showing contact all over after the first scraping.

Albany, N. Y. L. F. C. GEORGE.

The Grinding of Copper Rolls

I have read with interest what is said by A. B. Schliefer, at page 463, about grinding copper rolls. My experience has been like his, that is, I have never been able to grind such rolls smooth or with what would be called a good finish. I have found it very easy to grind such rolls round and straight with any one of a number of different grades of wheels and at any of many different speeds of work, but have never tried a wheel speed of 7300 feet.

It is true, as Mr. Schliefer says, that a B wheel is not made and if it were it would not hold together at any speed whatever, much less at 7300 feet. I would suggest that Mr. Abbott try to grind a

real copper roll himself. He evidently has not done so but has written of what others have told him during a visit to a works where this work was in progress. If Mr. Abbott is prepared to state positively that these rolls were *pure* copper and that he knows because he has himself analyzed the metal and that when ground the surface was smooth and the finish "all that could be desired," then it will be in order for some of us to do some more experimenting to learn how to get a good finish on *pure* copper. It is easy to finish any of the copper alloys.

Will Mr. Abbott explain why, in this case, they make an excellent finish when turning? His description of the turning would indicate that they take great pains to turn to an excellent finish. Why, if they afterward grind the roll, do they go to all that fuss with cutting compound and such a fine tool if they are to grind the rolls to a finish afterward? In fact, why do they turn them at all if they are to be ground? I have found in the case of pure copper that such a roll can be ground removing ⅛ inch from the diameter in about one-third of the time in which it can be turned, but this is not with a B wheel.

Mr. Abbott should ask that "machinist of the old school" once more what he uses. Perhaps this old-school machinist had an object in telling Mr. Abbott that the wheel was a "B." You know old-school machinists have been known to send apprentices after "strap oil" and "round squares."

Worcester, Mass. C. H. NORTON

Pitting with Barium Chloride

The statement of Wheelock, Lovejoy & Co., regarding the pitting of high-speed steel when heated in a barium chloride bath confirms the opinions I have heard expressed in various quarters. I cannot, however, reconcile the fact that high-speed steel does not melt at anywhere near the temperature given with the apparent melting at this point.

Is it possible that there is a local heat developed owing to the presence of something in the barium at the particular points?

When it first came to my attention I attributed the difficulty to defective pyrometers, assuming that the bath was really much hotter than the 2150 degrees stated, as according to all previous information, there should be no melting at anywhere near this point.

If the local melting does occur, it seems up to some of our chemical friends to tell us what makes it when the temperature of the whole bath is several hundred degrees below the melting point of high-speed steel.

Some claim that it is due to particles of carbon from the graphite crucibles and that it does not occur when a crucible such as used in melting steel is used for heating the chloride of barium. If this holds good in all cases it is an easy remedy but does not explain the reasons for the local heating.

New York. JOHN R. GODFREY.

The Bandsaw as a Machine Tool

The article under the above heading by Philip Bellows, on page 543, is very interesting and should be instructive to some who do not realize the usefulness of the bandsaw for cutting zinc, brass and many other metals. Many mechanics do not even know that there are bandsaws made expressly for metal work.

The shops in the Middle West, where I have seen metal bandsaws in use, could be numbered on the fingers of one hand, and two of these shops are railroad shops. The Chicago & Alton shops at Bloomington, Illinois, have one in their foundry for sprue cutting, and the Illinois Central shops at Burnside, Illinois, have one for cutting metallic packing gates. The other firms using them are the Firth-Stirling Steel Company, and Houghton & Richards Company, of Chicago. Both of these latter firms use them on tool steel; the former on the softer grades, as they use blue-chip circular saws on the regular stock, but the last named firm have four in constant use on all kinds of tool-steel and general job work. One job I saw them working on would have been extremely difficult to do on any other kind of a saw and one which would be difficult to do in a satisfactory manner at all, without special tools, except as they did it. The job was the shortening of several hundred ditching spades.

These spades were made in the usual way of shovel steel but by some mistake had been made nearly six inches too long. They were clamped three at a time in the regular vise used on the bandsaw machine and tilted so that the saw went through them in such a way as to leave a nice circular or "crowning" end. The steady pull of the saw in one direction reduced the vibration of the thin metal to a minimum, and made a smooth job. Some of these spades were so hard as to cause a sharp file to "stick" considerably, but the saw cut through them steadily and easily.

The saving of metal alone in cutting tool-steel with a bandsaw is quite an item as the thin blades cut only from one-third to one-fourth of the amount of metal cut by one of the common heavy hacksaw blades. Bandsaw blades cost less in the long run, length for length, than hacksaw blades, as they will cut more metal and, in addition, save in chips and time. An ordinary hacksaw machine is only cutting half the time and dulling or breaking the teeth the other half, while a bandsaw cuts with a steady, continuous motion

Decatur, Ill. ETHAN VIALL.

Casting One Metal on or in Another

With regard to casting wrought-iron, or forged-steel rods in cast iron, as mentioned by O. James on page 20, this has been advantageously and successfully done with very little trouble, and I can quote several instances which have come within my own personal experience. The corrugated curving and bending rolls for galvanized-iron sheets are merely chilled-iron castings, cast on a long wrought-iron bar or arbor. This bar is so much longer than the cast roller, that each end of the bar acts as a journal, and to which the gears are keyed; this case alone will prove the cast iron and wrought iron are

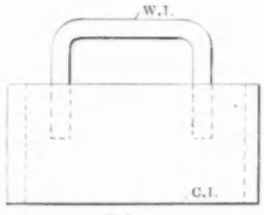


FIG. 1

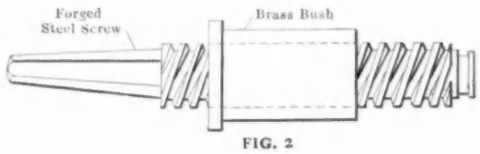


FIG. 2

CASTING METAL ON METAL

fused together sufficiently to resist all twisting or torsional strain.

Referring on page 244, to the method used to strengthen the metal at the top of a hammer base with reinforced rods This recalls to mind the plan adopted in an old shop of mine fourteen or fifteen years ago, for casting the wrought-iron handle or yoke in the tup for a drop press. Fig. 1 shows a sketch of this cast-iron tup with wrought-iron yoke "cast in," the only difference being, in this case, the projecting ends of the wrought-iron rods which R. B. L. used as supports in the mold and then cuts off, are cast in the tup, the loop end being stuck in sand; and surely the heavy duty, which a tup for a drop press is called upon to withstand, is conclusive evidence of perfect fusing.

These are all instances where one metal is cast on or in another, and is expected to remain a permanent fixture, or it would be useless; but there is another and distinctly opposite, side to the question under discussion, which seems to have been omitted, namely, casting one metal on or in another, the two metals eventually to be separated, and each to keep its true form when apart. As this process does not seem to be universally known, a very good example is shown in

Fig. 2; this is a forged-steel screw with a solid brass bush "cast in position." This also is a very old method which is adopted with satisfactory results in heavy screw-press work. The screws are from 1½ to 3 inches diameter, square threaded, with double and sometimes three leads. The bushings, which, of course, acts as a nut in which the screw, connected to the press slide, moves up or down are from 6 to 10 inches long. The forged-steel screw is first turned and thread cut in the lathe, sent to the brass foundry to have the bush "cast on." When they return from the foundry they are placed in the lathe again and turned on the outside and flange of bush, to suit the bored hole in the press. Then the bush is gripped in a special V-shaped vise and the steel screw loosened by means of a substantial wrench, or double-ended lever, which fits the taper shank, two boys accomplishing this with a liberal supply of oil and energy.

In conclusion I may say that this has proved, for many years, a practical, economical and most satisfactory method of manufacture.

Glasgow, Scotland. O. SAVILLION.

Cutting Steel with the Oxy-acetylene Blowpipe

EDITORIAL CORRESPONDENCE

An exhibition of cutting steel as well as a few stunts in welding, with the oxy-acetylene process of autogenous welding was given at Columbia University, New York City, on Friday evening by the Linde Air Products Company, of Buffalo, N. Y.,

Most of these jobs of cutting were truly wonderful, when compared with the way the same work was done, not over five years ago and practically less than three years ago.

The apparatus for doing the work consisted of a tank in which to generate the acetylene gas, similar to that used by all those who use acetylene gas, and the oxygen was supplied by storage tanks, that were charged at a pressure of about 1800 pounds per square inch. This oxygen is manufactured and stored in the tanks by the company and is guaranteed to be 95 per cent. pure.

The blow pipe was the one manufactured by this company under the Fouche patents. It is a low-pressure one, constructed on the injector principle, that is so designed that the flame cannot strike back. This makes it safe to use. The gases are well mixed in the injector chamber before they issue from the nozzle of the blowpipe, and carbonaceous deposit in the orifice is practically obviated.

The cutting operations, which were perfomed on the steel, were done without any preheating except in the case of the largest piece, which was 4 by 6 inches. Where possible, thick metals that are to be cut by this process, should be preheated to a high temperature, by a coke or charcoal fire, a gas blast, or some other means, as this greatly reduces the cost of the cutting operation; the oxygen being quite an expensive item when thick metals are to be cut.

CUTTING OPERATIONS

The first piece of steel that was cut was ⅝ inch thick, 10 inches wide and several feet long. This was laid on a bench, with the end projecting over the end of the bench and three pieces were cut off of the end of the steel plate by melting a kerf through it with the blowpipe. This made the cut ⅝ inch thick and 10 inches wide, and the first piece was cut off in one minute and five seconds; the second in one minute and three seconds; and the third in one minute and one second. The reduction in time from the first cut to the third was, no doubt, largely due to the fact that the metal was slightly preheated by the previous cuts. The kerf in these cuts was nearly ⅜ inch wide.

A standard 9-inch I-beam was next cut with the blowpipe in one minute and fifty seconds. This was stood up with the end projecting over the end of the table and the top flange, the web, and one-half of the botton flange was severed with one cut. The blowpipe was then taken to the other side and the opposite side of the bottom flange was cut and the piece, cut off, fell to the floor.

The last cutting operation was a steel bar 4 inches thick and 6 inches wide. This was a laminated bar made of four pieces riveted together, each piece being one inch thick and six inches wide. The bar was not laminated purposely, as a solid bar would conduct the heat much better, but it was the only thick piece which was near at hand. An extra strong blast of oxygen was turned on to make this cut, and it was cut off in 6 minutes and 20 seconds. The kerf was about ½ inch thick.

WELDING OPERATIONS

Two pieces of tubing, one inch on the outside diameter and with metal ⅛ of an inch thick all over, were welded together, on an angle of 45 degrees to make a right angle bend, in 3 minutes and 30 seconds.

Two cast-iron plates ⅜ inch thick and 2 inches wide were welded together, by the aid of a special iron flux which this company manufactures, in 3 minutes and 20 seconds.

Two aluminum pieces were also welded together by using a special aluminum flux which the company manufactures.

SUMMARY

These operations show the possibilities of the blowpipe, as well as the great improvements along this line since the process was first introduced into this country, about three years ago.

Of course, where the cold saw can be used to cut thick sections of steel it is much cheaper than the oxy-acetylene blowpipe. For emergency jobs, however, such as the cutting up of the steel in the Quebec bridge which fell; the tearing down of steel frame buildings; the cutting of sprues from large castings which are expensive to move to a cold saw; or other jobs of a similar nature, it can be made a commercial success.

As an instance of this the piece 4 inches thick that was cut at the exhibition was a very expensive proposition owing to the large amount of oxygen that was consumed in the operation, but if this piece was located at the curve of the stem, in the hold of a boat, the blowpipe would be the cheapest method of cutting it, owing to its being impossible to get any portable machine in there that could do the work.

E. F. L.

The Shop Joker Gets Caught

BY F. WEBSTER

The practical joker has always been in evidence in machine shops as it seems to be human nature everywhere to laugh at the discomfort or the predicaments of others. It is not often, however, that he deliberately plays a trick on himself as was done in the following case:

John was a stout young buck who had never taken anything in life very seriously and who had no definite idea of either where he was going or how he was to get there. On this particular day he had been using the chain hoist to get a heavy casting onto the planer. The hoist operated so easily that he thought it would be a fine stunt to lift himself. No one else was in that corner of the shop to witness his play. The hook was too high to step into so he evolved a wonderful new idea—simply pass the chain around his neck and pull away! No sooner thought than done, and his feet left the floor so quickly and with so little pulling effort on the chain that he instantly became confused and pulled madly at the chain to lower himself. But instead of going back to the floor he went higher because he pulled the wrong chain. He soon became unconscious and all hands in the shop would have had a half-day off to attend a funeral had not the Cub gone to that corner of the shop surreptitiously to get a bite from his lunch box. Though scared half out of his senses the Cub grabbed the limp form around the legs and lifted its weight from the chain, while he yelled the best he could for help. After being on the floor for a few minutes under a liberal sousing of cold water, John revived, and he was able next day for the usual business. However, the incident set him thinking along more conservative lines than he had done heretofore and his judgment became more dependable.

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A Homemade Shop

The idea of utilizing the workmen in a shop to rebuild it when the old one burns is certainly a novel solution of a difficulty which arises in some cases. In the usual procedure the men would be laid off, would become scattered, and when the new factory was ready, only a small portion would be available for the work with which they were very familiar, and it would be necessary to break in new men. Then, too, it would mean hardship to many of the men who might be compelled to abandon a little home, partly paid for, or to sell at a great sacrifice.

The Utica Drop Forge Company, when its old plant burned down, retained every man who wanted to stay and put them at work on the new factory at once. It meant hard, manual labor for men who were accustomed to light tool work and to keeping books, but it also meant steady employment at the same wage as before and a chance to retain all their home connections.

To the company it meant a band of workers who would push the new building to completion in the least possible time so as to get back to their old work; it meant keeping their organization intact so as to be ready to turn out work as soon as the machinery could be installed, and it meant a real interest in the building and the work such as comes from having played a part in its resurrection from the ashes of the old plant. Given something to be loyal to as a basis, and the actual building of the factory in which the work is to be done will bring out all the coöperation and helpfulness that is in a man's nature, this depending, of course, on the individual in question.

Whether the actual building cost of the plant was more or less than it could have been built for by contract is perhaps an open question, but the company feels that it paid in every way. Any visitor to the shop will see one of the happiest shop families we know of and every man is anxious to know what the visitor thinks of the shop, to point out its good features and to tell just what part he had in the making.

There are probably not very many cases where it would be feasible to do this owing to local conditions, or to the average mechanic not being suited to work of this kind except for a one-story shop. If the buildings had been several stories in hight, the case would be entirely different, as in that case it becomes much more of an engineering problem. But with a one-story shop it is not a difficult proposition, especially where concrete enters largely into the construction.

But the plan has many good points, and with modifications to suit conditions, is worthy of serious consideration by all who are interested in promoting harmony and loyalty in their working force. If you can get a man's interest in the building of something in which he is to live or work, or which affects him directly in some such way, he is a long ways on the road toward a loyalty and feeling of helpfulness that he had never known before. But this is not a one-sided proposition, for unless the other side responds in a similar manner, it is useless to expect everything from the man who works in the shop.

A Trade as a Means, not an End

A recent article in these columns treated of the highly organized industrial school system of Munich, Germany. One point there brought out was the difficulty of changing from one trade to another after a decision had once been made by a boy to take up the training necessary for a particular industry. In fact, as we understand it, it is almost impossible for such a change of avocation to be made, unless a boy's parents are able to place considerable money at his disposal in the nature of a subsidy. Thus the outlook before the average Munich boy, born of parents in humble circumstances, is to a trade as a means of livelihood and nothing else. As the decision in regard to what avocation he is to follow must be made by a boy, or his parents, when he is from 9 to 10 years old, the habit of mind of looking upon his life's work as lying wholly in some trade is early developed.

This condition is far different in America, and happily so; yet, this very difference may be one of the reasons for our apparent lack of skilled labor. In Germany his trade is an end, as far as a man's life's work is concerned. In America a trade is apt to be only a means to something better. In Germany a boy looks forward to a trade as a natural occupation, and in many cases undoubtedly follows in the footsteps of his father. In America an ambitious boy looks upon a trade as a means of livelihood for a few years only, or as a stepping stone to higher positions. The average American would prefer to do what is considered a higher class of work indifferently well, than to do what is considered a lower class of work extremely well.

This fundamental difference in the condition and attitude of German and American workmen, and boys who are to become artisans, should be clearly recognized when attempts are made to compare German industrial education, with the lines along which similar education is now developing in this country. One natural inference is that our education, while no less thorough, should be broader in its character and scope from the very fact that a boy may stay at his trade but a few years, and then step on to some other calling. Such a course will tend to develop better citizens, and is in keeping with American ideals.

New Tools and Machine Shop Appliances

Showing New Ideas in Machine Shop Equipment That Make It Possible To Do Better Work at a Reduced Cost

THE LATEST INFORMATION

A Motor-driven Lathe and Its Controller

The illustration, Fig. 1, shows a Reed lathe equipped with the Cushman drive, the motor being built into the head in place of the cone and looking very much like it. The only change noticeable is the extra gears *C*, and the handle in front.

The handle *D* controls all the electrical apparatus, starts the motor, cuts out the armature resistance and cuts in the field resistance for speed regulation. This is accomplished by the very ingenious starting and regulating rheostat *E*, which is out of the way under the lathe head.

When the lever *D* is removed to start the motor the regulator proceeds to cut out the starting or armature resistance. When this is done an auxiliary lever is released and any further movement of the handle *D* gives a change of motor speed, there being 12 steps or changes, aside from those obtained by the gearing.

For Screw Cutting

For screw cutting, with its frequent reversals, Mr. Cushman has devised a very neat arrangement somewhat on the order of the "pull" switches used in electric lighting for lamp sockets. By throwing a switch, which cuts in this automatic "reverser" all the operator has to do is to use the handle *D* in front of the apron. A slight pressure down, starts the lathe forward at the desired speed. When the thread tool has advanced to the desired point the next movement of the handle reverses the motor instantly and the carriage runs back. Another movement starts it forward again and so on till the thread is cut. All movements are in the same direction so that there can be no confusion and each movement reverses the motor at once. To anyone who was familiar with the tenderness of the early electric motors and the soothing way in which they had to be handled, it is a decided contrast to see a man operate this lathe and see the work run first in one direction and then the other.

While any mechanism, electrical or otherwise, is liable to wear and derangement, there is a lathe in the Cushman shop which has been in operation for three years without being repaired in any way and the commutator is in splendid condition in spite of varying loads and frequent reversals.

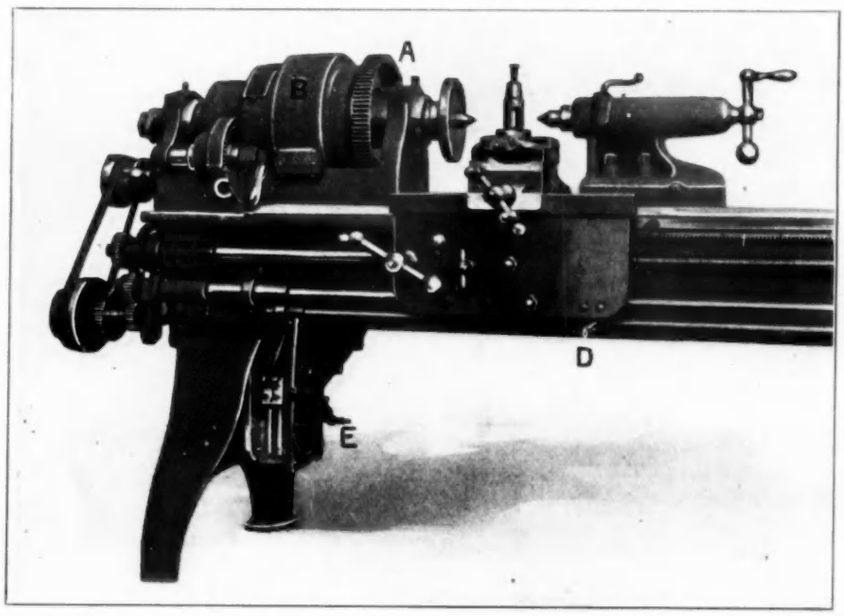


FIG. 1. MOTOR-DRIVEN ENGINE LATHE

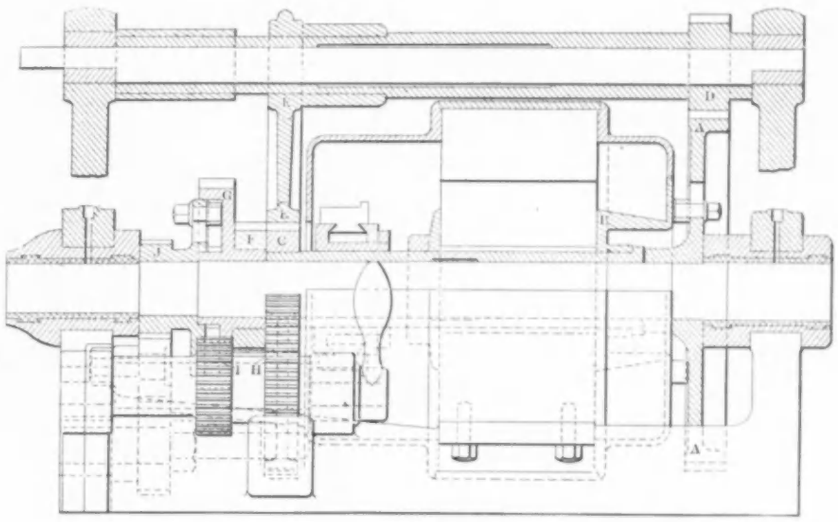


FIG. 2. DETAILS OF THE MOTOR HEAD

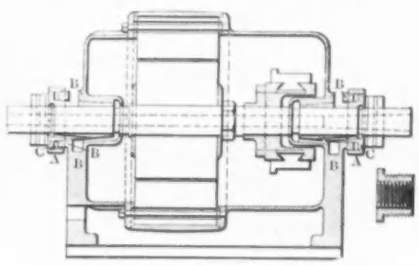


FIG. 3. MOTOR ON SPEED LATHE

Details of the Headstock

Fig. 2 shows the compactness of the motor-driven head, in fact the motor is built into the headstock, the armature turning on or with the lathe spindle as the case may be. The headstock is but slightly different from the standard, the length being a trifle more in this case (which shows a 14-inch Reed lathe), and the back gears being differently arranged.

The motor *B* is mounted on the long

sleeve which surrounds the spindle, the pinion *C* being also mounted on this sleeve and turning with the motor at all times just as the similar pinion always turns with the cone.

The motor is connected to the face gear *A* by the usual locking stud and, with both back gears thrown out, the motor drives the spindle direct with all the speed variations due to the motor itself. Unlocking the face gear and throwing in the usual back gear, the power is transmitted from *C* to *E* and through *D* to *A*, which, of course, turns the spindle.

Another speed is obtained by fastening *G* to *J* by the locking stud shown, so that the power comes from *C* to *H*, *I* to *G* and drives the spindle through *J* which is fastened to it. A still further speed reduction is obtained by sliding gear *E* over to *F* and throwing in the auxiliary back gears *H* and *I*. In this position *C* drives *H* and *I* drives *G*, while *F* drives back gear *E*. This makes four mechanical changes of speed.

Motor Headstock for Speed Lathes

The speed lathe head is extremely simple, as can be seen in Fig. 3. The armature is mounted directly on the shaft and the commutator is inclosed to be away from the dust. The bearings are hard bronze taper bushings, as at *C*, split to allow of adjustment and drawn into the headstock *B* by the right and left nuts *A*, which lock the bushings in any position.

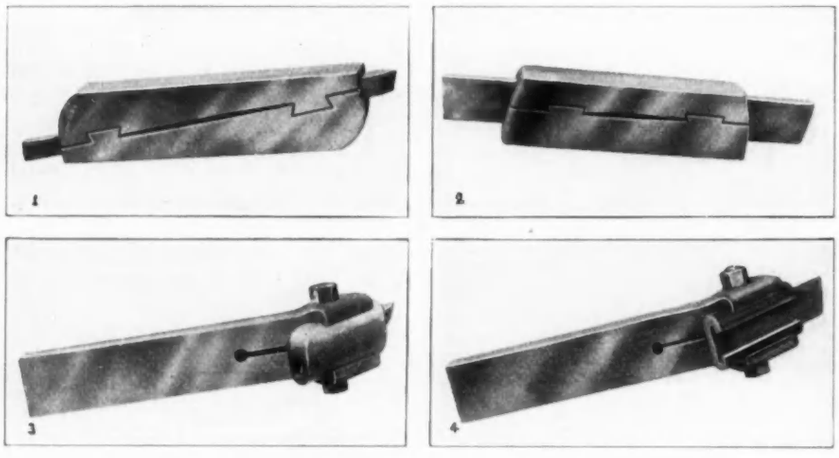
The bearings are lubricated by oil rings in the pockets shown and the grooves in the shaft retain the oil in the bearing, returning it to the oil well by the passages shown. These heads go largely into manual training and other shops and stand up in spite of the lack of care which a tool naturally receives from a boy. The regulator is very simple, gives 12 changes of speed by moving a small knob. These are built by the Cushman Electric Company, Concord, N. H.

New Inserted Tool Holders

The Clifford Tool Company, Concord, N. H., is bringing out two styles of a new line of tool holders, as shown in the accompanying illustration. The straight holders are shown in Figs. 1 and 2. The holders are made entirely of tool steel, are hardened and spring-tempered in oil so as to stand up under the clamping of the tool-post screws and also to hold the blades securely after they have been ground very short.

The holder is in two parts, prevented from separation by the dovetails and bearing first on the end of the cutter next the work. As an indication that it actually holds short cutters, a tool only 5/8 inch long over all has been used to take a cut 1/4 inch deep. A spring under the tool tends to hold it in place when being adjusted in a vertical position, as in planer work.

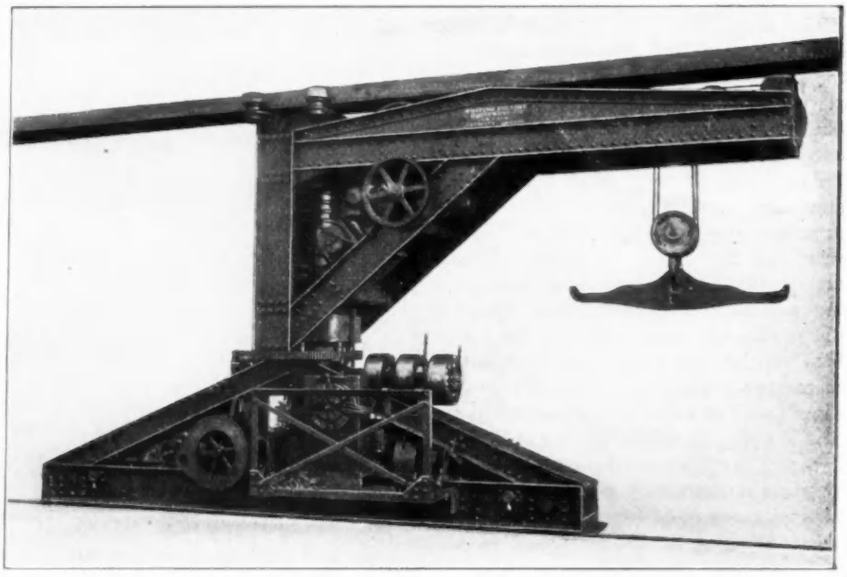
Figs. 2 and 3 show offset holders with different styles of clamps for the cutter itself. These can be used either side up and used either right or left hand. All the holders enable long cutters to be used if desired, or any short piece can be inserted and used up very closely.



THE CLIFFORD TOOL HOLDER

A Walking Jib Crane

A crane somewhat out of the ordinary, of the walking and jib type, has recently been installed in the Burnside shops of the Illinois Central railroad by the Whiting Foundry Equipment Company, Harvey, Ill. Its particular duty is to pick up wheels and axles and distribute them through the shop as desired.



WALKING JIB CRANE

There are four motors, a 2-horsepower for moving the trolley, one of the same size for turning it, a 10-horsepower motor for crane travel and a 15-horsepower for the hoist, which has a 7-ton capacity, and hoists 16 feet per minute. The jib has an effective radius of 12 feet and the whole crane runs on a one-rail track at the bottom, while an I-beam at the top supports the top of the mast. It runs close to the columns which separate the erecting floor from the machine shop so that it serves both the wheel lathes and the erecting pit. The jib does not raise and lower, but has a maximum lift of 10 feet. The trolley travels 90 feet per minute on the jib which swings at the rate of two revolutions per minute.

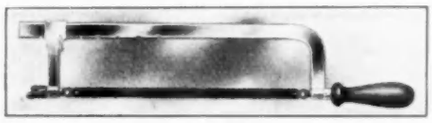
It is important that the load is always in absolute control, being automatically sustained at all times. The hoisting gearing is provided with improved double automatic safety brake, so arranged that load may be raised and lowered by power and be automatically sustained. This brake attachment consists of two independent brakes, one electrical and the other mechanical. The electrical brake

is operated by an electric solenoid in circuit with the hoisting motor, and so arranged as to come automatically into action when the electrical current is off the hoisting-motor circuit.

It is claimed that this crane gives a maximum of efficiency both as to cost of installation and of service.

A New Hack-saw Frame

The special feature of this hack-saw frame is the method of holding the blade

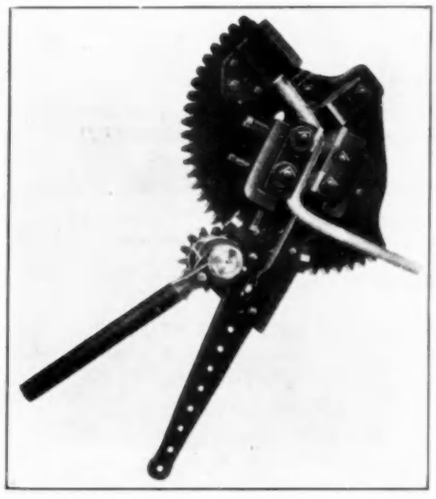


NEW HACK-SAW FRAME

in place on the pins by nurled nuts to avoid its falling off when loosened for adjustment. The blade will hold from 6- to 12-inch blades and each notch is marked with the size it accommodates. Provision is made for turning the blade in four different positions. It is made by the West Haven Manufacturing Company, New Haven, Connecticut.

Machine for Bending Rods

While this has been designed to bend rods for reinforced-concrete work, it has other applications that will be apparent. It will handle rods of 1 inch and under cold, and can be used for hot work as well. The illustration shows a rod being bent. The steel plates prevent undue wear at the vital points. The dies can be adjusted as shown.



MACHINE FOR BENDING BARS

For bending large work the ratchet and reduction gear of 4⅔ to 1 are used, while for light work, the gear is removed and the handle used direct. The machine is fastened to a post or other convenient place to be used. It weighs 235 pounds, and is made by the Wallace Supply Company, Chicago, Illinois.

An Inclosed Pinion Drill Chuck

The illustration shows the latest improvement of the Almond drill chuck. The body of the chuck is recessed to receive a pinion which meshes with teeth cut on the front of the geared nut. The pressure on the nut being at the back, the same wearing surface is preserved as in the former chuck of this make. A cap covers the pinion and provides a support for the outer end of it, while the inner end of the pinion has a bearing in the body of the chuck. Both the pinion and nut are made of a special grade of tool steel tempered. There are no projections on the chuck, the pinion comes flush with the surface of the chuck body and has a square hole in it to fit the key. The

INCLOSED PINION DRILL CHUCK

nurled sleeve can, as formerly, be used for quick adjustments while the key is used for the final tightening.

This chuck is made by the T. R. Almond Manufacturing Company, Ashburnham, Massachusetts.

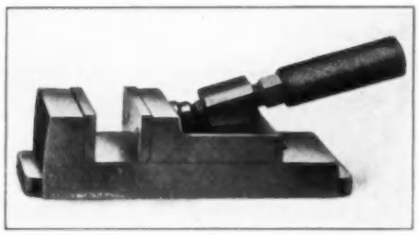
Jensen Logarithmic Paper

The Jensen logarithmic cross-section paper differs from the usual logarithmically ruled cross-section paper in that each side is graduated from 1 to 100 in logarithmic divisions. Each sheet really consists of four complete logarithmic sections; thus it is adapted for many purposes requiring a wide range of quantities. The size of the ruled diagram is 10x10 inches, and the size of sheet is 10x17 inches. It is printed in a neutral tint that lends itself readily to photographing and blueprinting.

This paper has been copyrighted, and is for sale by J. Norman Jensen, 797 North Leavitt street, Chicago, Illinois.

A Quick Acting Vise for Drill Press Work

The Armstrong Brothers Tool Company, Chicago, Ill., has brought out a drill vise that promises to be very handy for the operator. The nut through which the hand screw works is hinged to a block which slides in the slot in the base and is drawn up against angular surfaces on the under side by the action



QUICK ACTING DRILL VISE

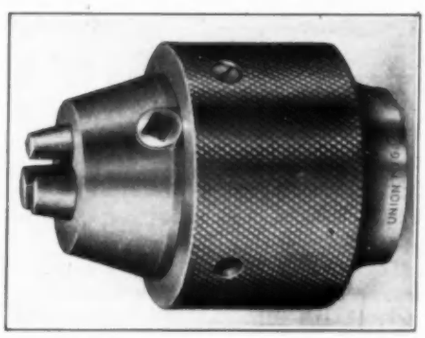
of the screw against the jaw and through this, the work.

The handle is large and heavily nurled so that it is easy to secure sufficient pressure for most work by a twist of the wrist, but if necessary a wrench can be used on the hexagon at the inner end of the handle. Releasing the screw and raising the handle allows the movable jaw to be moved to any position so that only a slight adjustment is necessary to securely fasten any work to be drilled.

This is made in three sizes, the largest having jaws 3½ inches wide by 1 7/16 inches deep, and an opening of 3 inches.

Union Geared Drill Chuck

This is along the lines of the Czar drill chuck, which has been made for several years, the improvement being the addi-



UNION DRILL CHUCK

tion of the bevel pinion shown, for tightening. It still retains all the features of hand or spanner adjustment, and the gearing, being inclosed, keeps it away from dirt and chips. It is made by the Union Manufacturing Company, New Britain, Connecticut.

The Waltham Bench Lathe

Bench lathes are growing in favor in many shops for use in tool rooms and on small work generally, and they are being improved in various ways. This lathe is the latest product of the Waltham Machine Works, Waltham, Mass., and has several interesting features. Fig. 1 gives a general idea of the lathe showing the index pin at the front edge of the cone and the stop pin at the back so that the index holes can be kept for indexing only. There are three sets of index holes, 48, 69 and 100 divisions. The bearings are straight, running in split taper bushings, the inside faces of these serving as thrust bearings.

The tail spindle is 9½ inches long and always has a full length bearing of 6¼ inches in the tailstock. It is graduated as in the hub of the hand wheel. The slide rest goes directly on the bed and has a squaring device, shown at the left of the attachments in Fig. 1. This bears against the front of the bed below the head- or tailstock so as to give a long bearing regardless of the position on the bed. These are made both plain and swiveling as desired; the swiveling stop can be swung to 45 degrees.

The slide rest also has a swivel, and by using these together, setting the lower swivel for one taper and the slide rest for another, two angles can be had at one setting. This is useful in many kinds of work, such as special mills, spindles, etc. The slide-rest swivel is clamped by one lever which operates two bolts on opposite sides of the central pin. Feed screws have hardened bearings and are fitted with indexes to read 0.001 inch on the swivel screw and 0.0005 inch on the cross-slide screw. This reduces the diameter of a piece of work 0.001 inch for each graduation of the cross-feed screw. The tool slide is made flat on top to take different attachments and has two T-slots.

Two grinders are made, one for inside and the other for outside grinding, both being clamped to the top of the tool slide instead of being fastened in the tool post. These have a vertical adjustment to the spindle for alinement of centers, and a wheel may be used on either end of the spindles. The overhead counter allows 12 grinding speeds between 1000 and 11,000 revolutions per minute.

Screw Cutting

Two ways are provided for cutting screws, as shown in Figs. 3 and 4. The first is the one recommended for rapid production, and is a modification of the well known Fox lathe principle. The master screw, shown on the splined rod, can be driven at different rates by change gears on the head. In this way three master screws give 19 threads from 6 to 80 per inch. Metric master screws are also furnished when desired. Circular thread cutters are recommended as it is easy to tip them to the required angle in either direction, although a regular tool post can be supplied if desired. This attachment can easily be tipped out of the way when the slide rest is used.

For cutting screws with the slide rest a train of three inclosed gears is used instead of the usual rod and universal joints, as it is believed this is better and more durable for accurate work.

The milling rest in Fig. 2 has been designed to dispense with the use of idler pulleys for maintaining the belt tension when the cutter is adjusted vertically. This is done by driving to a shaft that is always at the same hight, but which will drive the cutter spindle at any hight or any angle through the train of connecting gears. Each horizontal slide can be swiveled through a full circle so that any angular cut can be made by using the cutter spindle vertically. The cutter spindle takes the same chucks as the lathe,

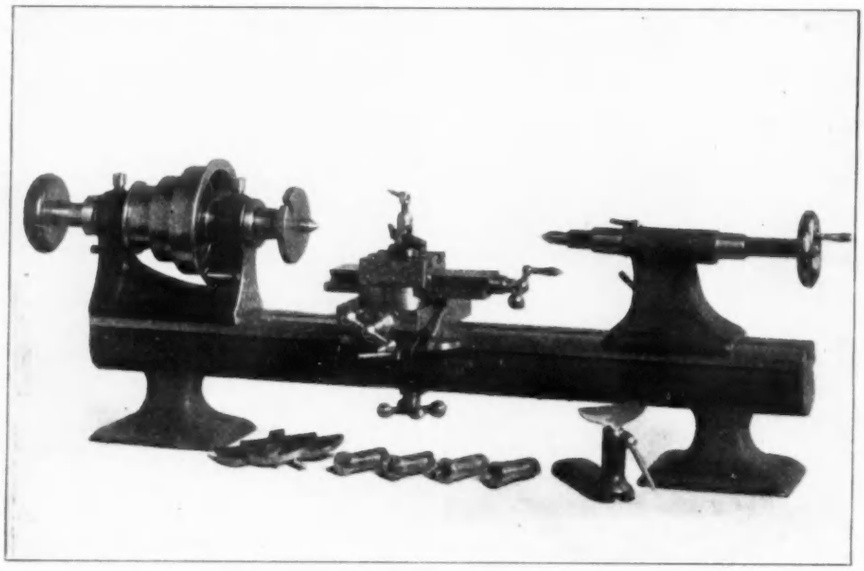


FIG. 1. THE WALTHAM BENCH LATHE

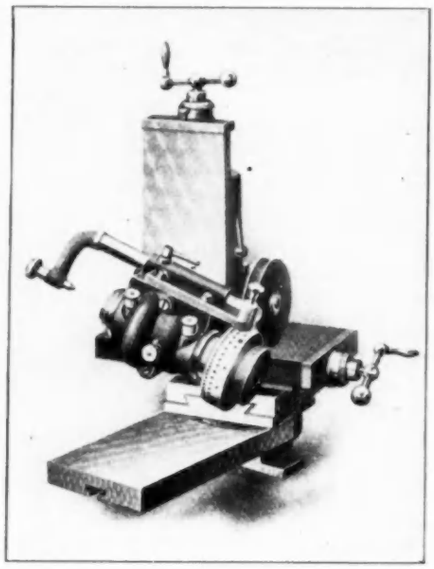


FIG. 2. MILLING ATTACHMENT

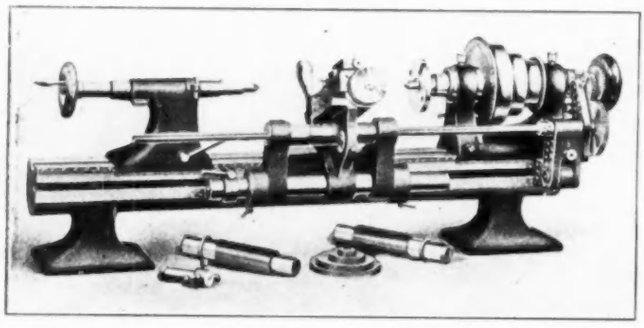


FIG. 3. ONE WAY OF CUTTING SCREWS

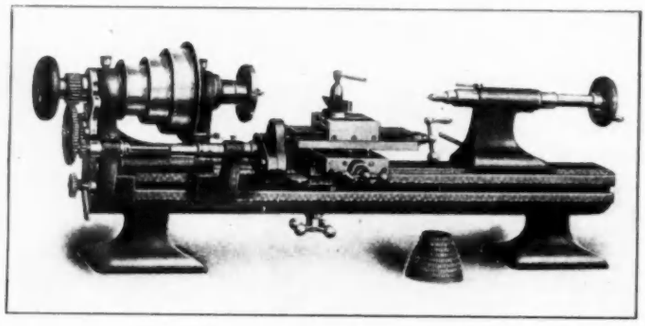


FIG. 4. USING THE SLIDE REST

and there is an index with three circles of holes so that the work can be held in this attachment while the cutter or grinding wheel is carried by the lathe spindle.

The lathe swings 8 inches and is made in two lengths, 32 and 36 inches. When desired a geared head can be used in which the back gears are all concealed inside the cone, and give a 4 to 1 reduction of speed. Numerous attachments are made for special purposes, the T-slot in the bed being convenient for holding them in place.

Tool Holder for High-speed Steel

The tool holder, shown with this, needs very little description, as its action is so apparent from the illustration. It is made in two styles, Fig. 1 having a plain shank

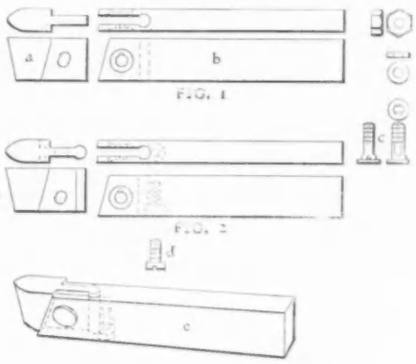


FIG. 1

FIG. 2

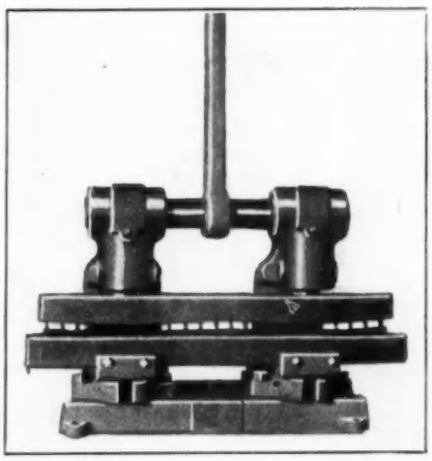
HIGH-SPEED TOOL HOLDER

to the cutter and depending on the bolt *c*. In Fig. 2 the end is enlarged to fit the holder and take the strain due to the action of the tool point. With this style the screw *d* ejects the cutter when necessary.

The holder is made of low-carbon steel and case-hardened, the tools being high-speed steel. They are made by the Baush Machine Tool Company, Springfield, Mass., from the designs of Frank E. Bocorcelski, their superintendent.

A Multiple Hand Punch

Sheet-metal workers often need to punch a number of holes at once in order to duplicate work and do it quickly. This is a hand-operated machine carrying 25 punches in the upper bar which is so



MULTIPLE HAND PRESS

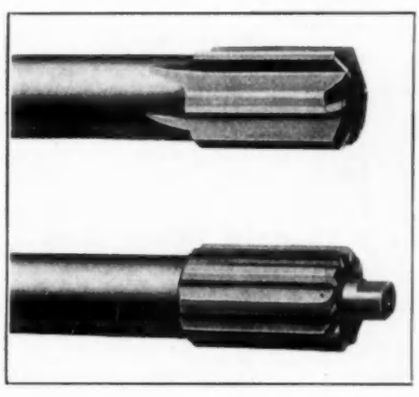
shaped that only four punches at different points on the bar, strike at once. As soon as these are through others just come into contact with the sheet so that it is easy to handle No. 16 gage sheet steel without difficulty.

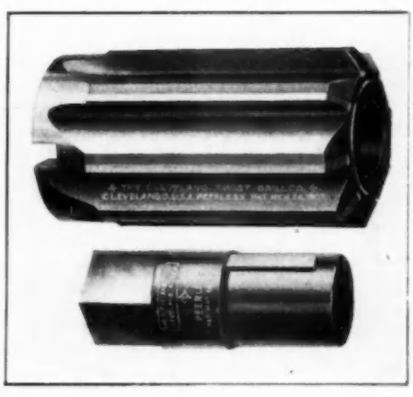
Any of the punches can be removed at will to vary the spacing and all are interchangeable. The working parts are of tool steel. It is made by the Lansing Machine Company, Lansing, Mich.

High-speed Reamers with Soft Shanks

In order to reduce the cost of high-speed steel reamers the Cleveland Twist Drill Company, Cleveland, Ohio, has developed a process known as brazo-hardening by which they unite high-speed blades to a soft-steel body as shown in Fig. 1. As only the blades are hard the reamer combines the cutting qualities of the high-speed steel with the strength of the low-carbon steel.

They are also making this in expansion reamers as in Fig. 2, where the body is slotted and the inner cone expands the reamer at the point and varies the amount of longitudinal clearance. In the shell reamer, Fig. 3, the expansion is adjusted by the plug, Fig. 4, in which the key engages the adjusting cone. Shell reamers are also made without the adjusting feature. They are all known as "Peerless" reamers.

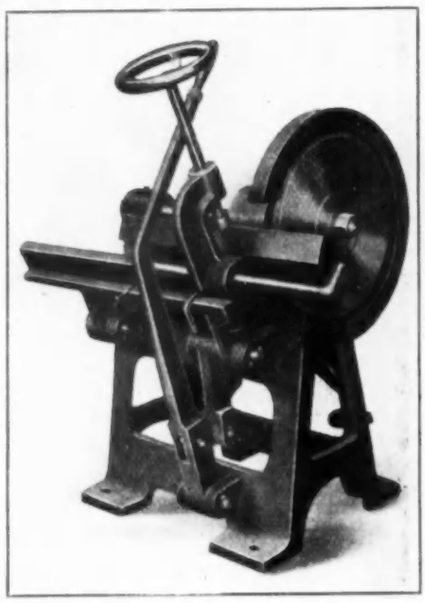




PEERLESS REAMERS WITH HIGH-SPEED BLADES

New Hot or Cold Saw

This is designed especially as an adjunct to a forging plant to assist in the rapid cutting of bar stock, or to trim the ends from forgings. The stock to be cut is clamped, as shown, and swung against the saw by the lever combination shown.



NEW HOT OR COLD SAW

The saw is 20 inches in diameter by ⅛ inch thick and runs 2500 revolutions per minute, driven by a 4-inch belt. It will cut iron and soft steel up to 1½ inches cold and any hot steel up to 3 inches. It is made by the Billings & Spencer Company, Hartford, Conn.

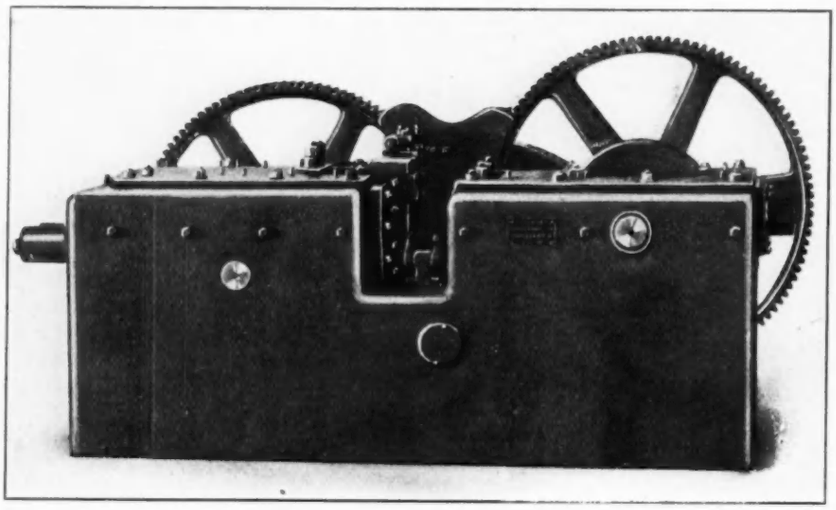
Machine for Hot Pressed Nuts

This machine has been especially designed to meet the exacting requirements of modern high-speed production of hot-pressed nuts with a low cost for repairs. The bed is a single steel casting estimated to be four times as strong as an iron bed of the same weight. All gears are made from steel casting, and have cut teeth. The cutter, crowner and piercer slides are steel castings, while the linings are of hardened tool-steel, phosphor-bronze and cast-iron strips, plates and

bushings. The operating cams are steel castings with hardened tool-steel faces running against hard-steel rollers.

When the piercer is punching the nut, all the rest of the mechanism ceases its motion so that there is never any pressure on the nut during the moment of piercing, thus lessening the tendency to strip or score the punch or piercer. The bed of the machine is so designed as to contain oil pools into which all the cams dip at every revolution.

The new movements introduced into these machines, together with their great weight and power, make it possible to make steel nuts on them just as readily as iron nuts. This is one of a line made by the Acme Machinery Company, Cleveland, Ohio.



MACHINE FOR HOT PRESSED NUTS

Business Items

Keuffel & Esser Co., New York City, has opened a branch house in Montreal, Canada, at 252 Notre Dame street.

On November 1 the executive offices of the Canadian General Electric Company and Canada Foundry Company were moved to 212-218 West King street, Toronto, Canada.

The Fosdick Machine Tool Company, Cincinnati, O., has appointed Perkins & Frecker, New York City, agents for their line of radial drills for New York City and vicinity, and Mortimer & Alcorn, Cleveland, agents for their complete line of radial drills and horizontal boring, drilling and milling machines for northern Ohio.

Pitt & Scott, Ltd., 35-37 Broadway, New York, has leased a six story building in London where it will open a "Bureau of American Manufacturers in Europe" for the display and sale of goods of the American manufacturers who rent space. A staff of experienced salesmen will be engaged and a comprehensive system of reports on foreign conditions will be furnished those who exhibit.

The American Compressor and Pump Company has been organized for the manufacture of air and gas compressors, air receivers, high duty vacuum pumps, pneumatic specialties, etc. Its works are located at 718 East Pratt street, Baltimore, Md., in charge of Alex. Slaysman, Jr., and its sales department is in charge of Frederick B. Vail, offices in Havemeyer building, New York City.

The Koentizer Tanning Company, Saginaw, Mich., is having a new plant erected.

The brass refining plant of Harry Butters, Cambridge, Mass., was destroyed by fire.

Prier Brass Manufacturing Company, Kansas City, Mo., will erect brass foundry.

The Runkie (Ia.) Canning Company will erect a plant. C. M. Hughes, president.

Independence (Mo.) Planing Mill and Supply Company will rebuild plant recently burned.

It is announced that the Petroleum Iron Company will enlarge its plant at Sharon, Penn.

The Emerson Steam Pump Company, Alexandria, Va., has purchased site for a new plant.

The Decker Electrical Manufacturing Company, Philadelphia, Penn., will erect an addition.

The Brannum-Keene Lumber Company, Indianapolis, Ind., will build a planing mill.

The plant of the Tomahawk (Wis.) Woodenware Company will be enlarged, it is said.

W. J. Barran & Company, Norfolk, Va., printers and bookbinders, will erect a new plant.

The Wolf River Paper and Fiber Company, Shawano, Wis., will rebuild mill, doubling output.

The Navy Department, Bureau of Supplies and Accounts, Washington, D. C., will open the following bids: November 17—Pneumatic hammers, drills, etc. (schedule 562), hack-saw blades, twist drills, chucks, screws, taps (schedule 558), steel (schedule 556). November 24—Engine lathes (schedule 543), tool grinding and shaping machine (schedule 542), pipe and fittings (schedule 546). December 8—High speed multiple drill, molding machine (schedule 539).

Trade Catalogs

S. A. Woods Machine Company, Boston, Mass. Pamphlet describing truing devices for wood planer and matcher knives. Illustrated, 24 pages, 6x9 inches.

American Spiral Pipe Works, Chicago, Ill. Catalog No. 5, of spiral riveted pipe, forged steel pipe connections, exhaust steam and hydraulic supplies. Illustrated, 78 pages, 8x10½ inches, paper.

Business Opportunities

Thompson & Snow, Chester, Mass., are erecting a new woodworking shop.

The Frisbie Motor Company, Middletown, Conn., will erect a new factory.

Want Advertisements

Rate 25 cents per line for each insertion. About six words make a line. No advertisements abbreviated. Copy should be sent to reach us not later than Friday for ensuing week's issue. Answers addressed to our care will be forwarded. Applicants may specify names to which their replies are not to be forwarded but replies will not be returned. If not forwarded, they will be destroyed without notice. No information given by us regarding any advertiser using box number. Original letters of recommendation or other papers of value should not be inclosed to unknown correspondents. Only bona fine advertisements inserted under this heading. No advertising accepted from any agency, association or individual charging a fee for "registration," or a commission on wages of successful applicants for situations.

Miscellaneous Wants

Test indicators. H. A. Lowe, Cleveland, O.

Caliper list free. E. G. Smith Co., Columbia, Pa.

Steel case hardened; modern methods. Boston Gear Works, Norfolk Downs, Mass.

We buy or pay royalty for good patented machine or tool. Box 282. AMER. MACH.

Tools and fixtures designed for interchangeable work. Fred L. Fay, Wilmington, Del.

Wanted—Orders for brass goods. Catsings and finished product. Box 601, AMER. MACH.

Hand power bending tools, labor-saving, money-making. Estep & Dolan, Sandwich, Ill.

Braze cast iron with Universal Fluxine, $.50 per pound. Universal Fluxine Co., Urbana, Ohio.

Machinery built to order. Up-to-date plant. Write Brunswick Refrigerating Co., New Brunswick, N. J.

Light fine machinery to order; models and electrical work specialty. E. O. Chase, Newark, N. J.

Mechanical drawings correctly and quickly made. H. C. Karson, Room 123, 39 Cortlandt St., New York.

Machines designed; automatic, special. Practical working drawings. C. W. Pitman, 3519 Frankford Ave., Philadelphia, Pa.

Special machinery accurately built. Screw machine or turret lathe work solicited. Robert J. Emory & Co., Newark, N. J.

Don't spend a dollar on patents until you have read our free book. Benjamin & Bassett, 514 F Street, Washington, D. C.

British patents law. Factory sites between Liverpool and Manchester with water, coal, electric power, railroad, tramcars. Hulton Park, Bolton, England.

Special machinery and duplicate machine parts built to order; tools, jigs and experimental work; complete modern equipment. MacCordy Mfg. Co., Amsterdam, N. Y.

Lathe and machine work of every description, patterns, gear cutting, screw machine work, iron, brass and aluminum castings. The Sipp Electric and Machine Co., Paterson, N. J.

Automobile manufacturer preparing new factory specifications desires catalogs of all classes of machinery, etc., used in automobile factory. Wilson Motor Car Co., Mt. Airy, Philadelphia.

Unrefined oil-motors; solvable firm of Budapest is looking for representation of oil-motor factory. Answers are asked sub "oil-motors," care Rudolf Mosse Advertising Office, Budapest, Hungary.

A large English firm of machine-tool importers having showrooms and offices in Great Britain, France, Italy and Japan, is wanting good agencies for machine tools of all kinds. Apply Box 189, AMER. MACH.

I have a very good improvement in "thread intercutting tool;" will give one-half interest to right party. Inventor wishes also to take out foreign patents. Robt. Klotz & Co., Patent Attorneys, 911 Schiller Bldg., Chicago.

Machinery built to order and by contract; special parts made; gear cutting, automobile and pattern work, punch press and screw machine work, tools, dies, etc. Blair Tool and Machine Works, West and Morris Sts., New York City.

U. S. patent on a novel tool for making washers at one operation, for sale. It is the only tool in existence. Washers can be made of all soft materials, as well as of fiber, brass and iron. From one to five thousand washers can be made in an hour with this hand operating tool. Address A. Zidovec, 19 Pine Place, San Francisco, Cal.

Situations Wanted

Classification indicates present address of advertiser, nothing else.

CONNECTICUT

High-grade superintendent wants good position; up in recent methods in all departments. Energetic, executive, a producer. Box 606, AMERICAN MACHINIST.

Position as blacksmith foreman; long experience in charge of drop, trip, steam hammers, hand forging, treatments of steel. Box 609, AMERICAN MACHINIST.

ILLINOIS

Assistant superintendent or chief draftsman, expert at designing special machinery and tools. Box 610, AMERICAN MACHINIST.

Designer experienced on machine tools, stamping presses and dies, special and automatic machinery for reducing cost of manufacture. Address "Designer," AM. MACH.

Wanted—Position as advertising manager; have had years of experience in building catalogs, booklets, folders, etc., also have a practical knowledge of printing values and all details in connection therewith; I hold similar position at the present time, but for good reasons desire a change. Address "A. R. M.," 1457 Wilson Ave., Chicago, Ill.

MARYLAND

Mechanical expert, practical, inventive and systematic, desires responsible position. Box 551, AMERICAN MACHINIST.

NEW YORK

Draftsman, experienced marine and stationary, pumping, refrigeration machinery, desires position; 35 years. Box 604, AM. M.

Draftsman wishes change; young man with 12 years' experience in designing and developing automatic machines. Box 603, AMERICAN MACHINIST.

A-1 tool maker and designer; inventive ability; special tools, dies, automatics and adding machines; 30 years' experience; can handle few men; references. Box 597, AM. M.

Draftsman, nine years' shop experience, and six years' designing tools, special and automatic machinery, desires position. Can take charge. References. Box 600, AM. MACH.

Designer, age 31, graduate engineer, wide experience special, automatic and fine machinery, experimental design, tools, fixtures; very able man; location immaterial. Box 605, AMERICAN MACHINIST.

Master mechanic is open for engagement as superintendent; technical education; 18 years' practical experience designing and constructing dies, fixtures and special automatic machinery. Box 607, AMER. MACH.

First class mechanical draftsman and designer wants situation in New York City. Special machinery or automobile work preferred. Salary $21.00 per week. Best references. Box 592, AMERICAN MACHINIST.

Draftsman, with 14 years' shop and office experience, locomotive design, special work, systematic rearrangement of equipment in machine, boiler shops, etc., to reduce unapplied labor and increase output. Box 506, AMERICAN MACHINIST.

Superintendent or general manager, 20 years' experience in machine shop, gray iron and brass foundries; largely hand, triplex power and steam pumps; designing, manufacturing and selling. American, technical graduate, practical, executive; very successful in reorganizing and modernizing for low cost production. Address Box 585, AM. M.

Mechanical engineer and designer; technical education; nine years' experience in machine, gasolene engine design, concrete masonry, plants, industrial traction, coal handling, conveying. Shop, chief of drafting room and office engineering; competent to take charge of construction or manufacturing work. Ambitious, resourceful and original. Box 602, AMERICAN MACHINIST.

OHIO

Technical graduate, age 26, 4 years' in shop and drafting room on machine tools and general work, wishes position in southwestern Ohio; sales department preferred; salary moderate. Box 608, AMER. MACH.

OREGON

Master mechanic with extensive and varied experience constructing and manufacturing in the States, Canada and South America, age 39, desires position where a responsible, high-grade, broad-gauge man is wanted. Box 720, St. Johns, Oregon.

PENNSYLVANIA

First class gas engine draftsman and designer now employed, desires change. Fair technical education. Familiar with latest practice here and abroad. Box 581, AM. M.

High-grade superintendent seeks position with progressive firm; thoroughly familiar with best modern practice in all departments. Expert designer of jigs and fixtures for rapid and accurate production. Experienced, energetic and a producer. Box 569, AMERICAN MACHINIST.

Help Wanted

Classification indicates present address of advertiser, nothing else.

MASSACHUSETTS

Sales manager wanted by growing concern manufacturing a line of high grade grinding machines. Previous experience in selling machine tools is absolutely necessary. Please write fully as to age, experience and salary expected. Box 591, AMERICAN MACHINIST.

MISSOURI

Wanted—High-grade, experienced machine tool salesman to travel in St. Louis territory. Box 571, AMERICAN MACHINIST.

NEW JERSEY

Wanted—A number of A-1 machinists on small precision machines, automatic machines, tools, etc. Also a number of expert die makers on both subpress and open die work. None other than first-class men need apply. Box 599, AMERICAN MACHINIST.

NEW YORK

Wanted—Patent office draftsman familiar with electrical work, for steady position with reliable concern in New York City. State age, experience and salary expected. Box 598, AMERICAN MACHINIST.

Wanted—One patent office draftsman familiar with electrical work, for steady position with reliable concern in New York City. State age, experience and salary expected. Box 593, AMERICAN MACHINIST.

Salesman with shop experience to sell small tool of recognized merit used in all machine shops. To receive attention, applicant must give age, experience and salary expected. "Mechanical," AMERICAN MACHINIST.

Wanted—Experienced machine designer to take complete charge of drafting room of large manufacturing concern. Man with experience on automatic machinery and tools preferred. Address "B. B.," care AM. MACH.

For Sale

Classification indicates present address of advertiser, nothing else.

For Sale—Well established machine shop in Mississippi town of 12,000, been running 20 years, have no competition. R. C. Lynn, Yazoo City, Miss.

For Sale—Variable speed countershafts made by the Moore & White Co. As good as new; big bargains for quick buyers. Rushmore Dynamo Works, Plainfield, N. J.

For Sale—United States letter patents of a perfected safety device of proved merit for applying to elevators. Sale necessitated by settlement of estate. Box 575, AM. MACH.

For sale, absolutely new, a No. 2½ heading machine and a No. 2½ reheading machine, Waterbury-Farrel make, never used. Ohlen Company, Box 740, Columbus, Ohio.

For Sale—Tracings, patterns, jigs and templets for the following size gas and gasolene engines: 1½, 3 and 5 horsepower vertical and 3, 5, 8, 10, 12, 16 and 20 horsepower horizontal; also a number of finished and unfinished engines of the above sizes. All of the above sizes have been in successful operation for several years. This is a splendid opportunity for anyone wishing to build gas or gasolene engines. You can save thousands of dollars in experimental work by purchasing this complete outfit. Shop rights of valuable patents on these engines will be given to purchaser. Box 366, AMER. MACH.

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